THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1602.] LONDON, JANUARY 23, 1894. [46TH YEAR. PRICE 6d.

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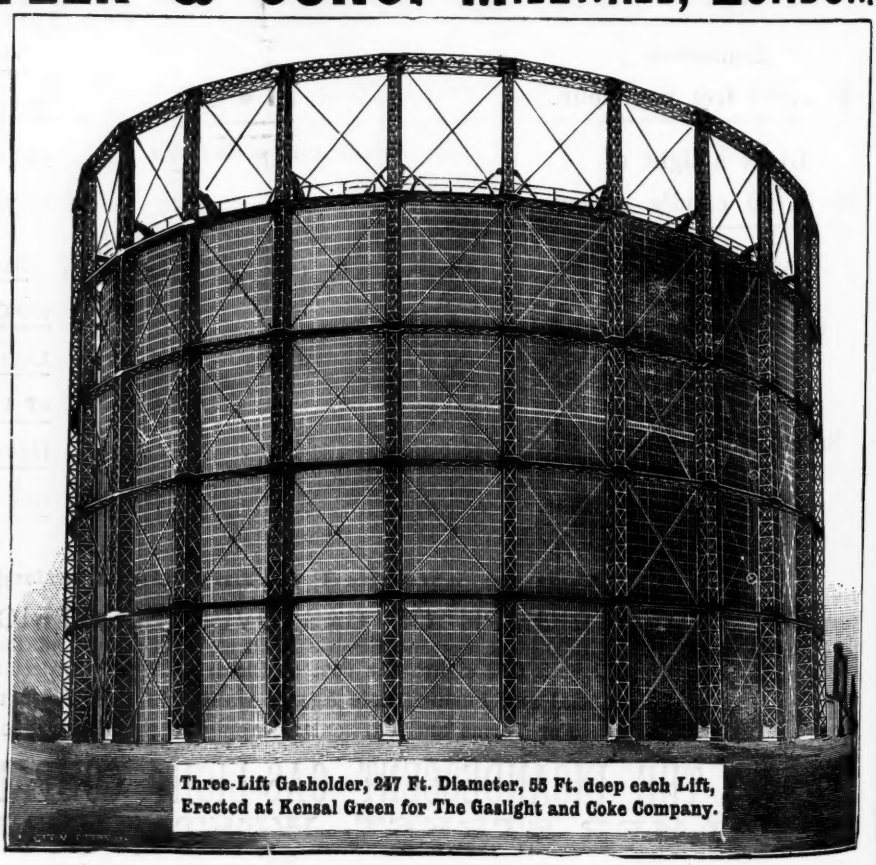

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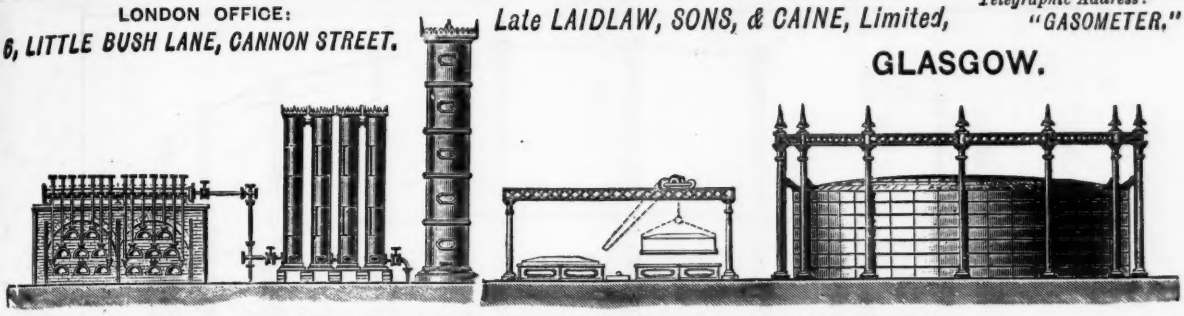

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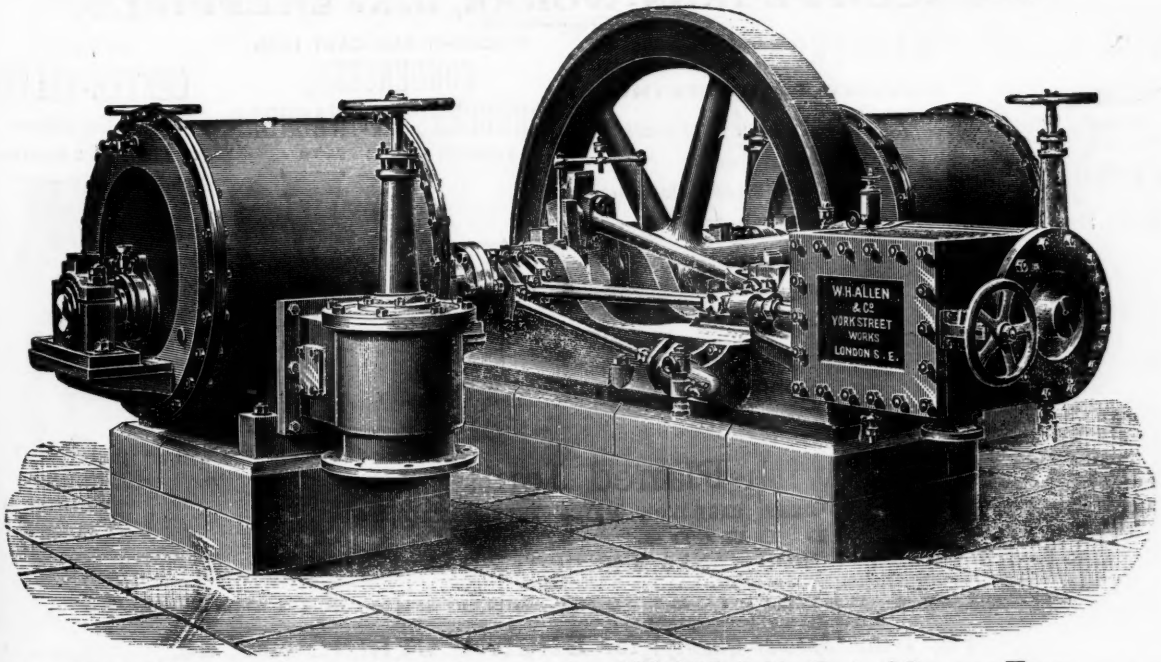

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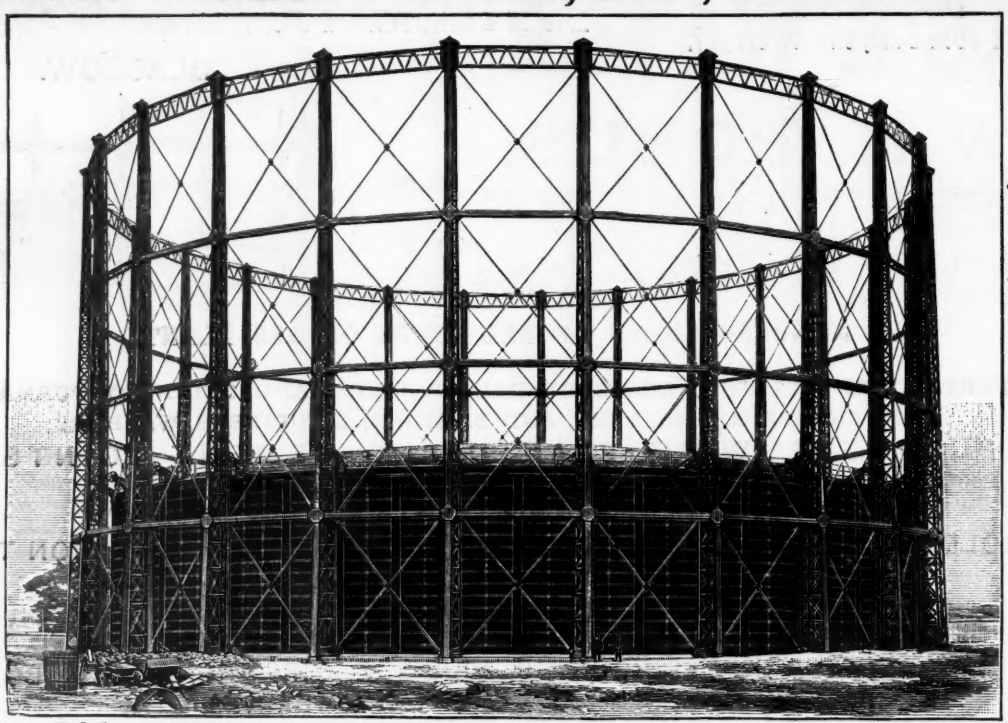

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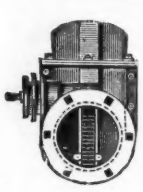

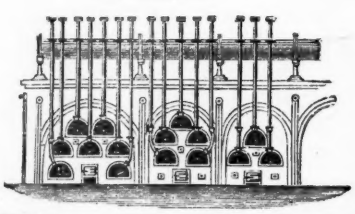

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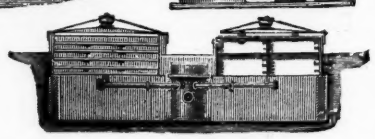

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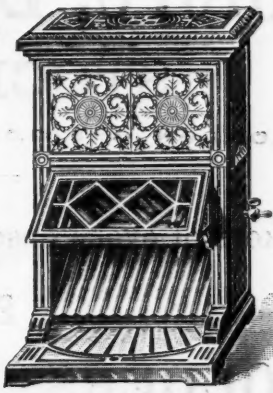

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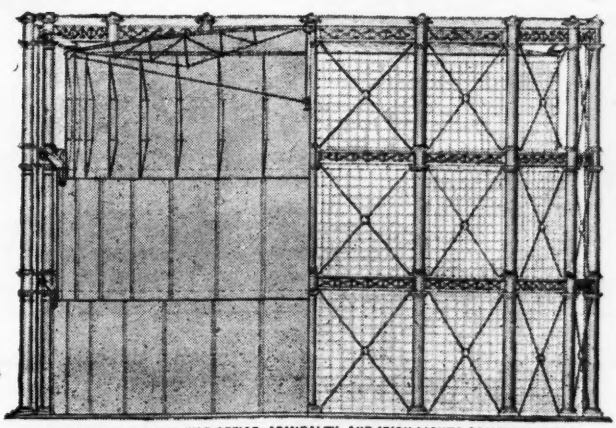

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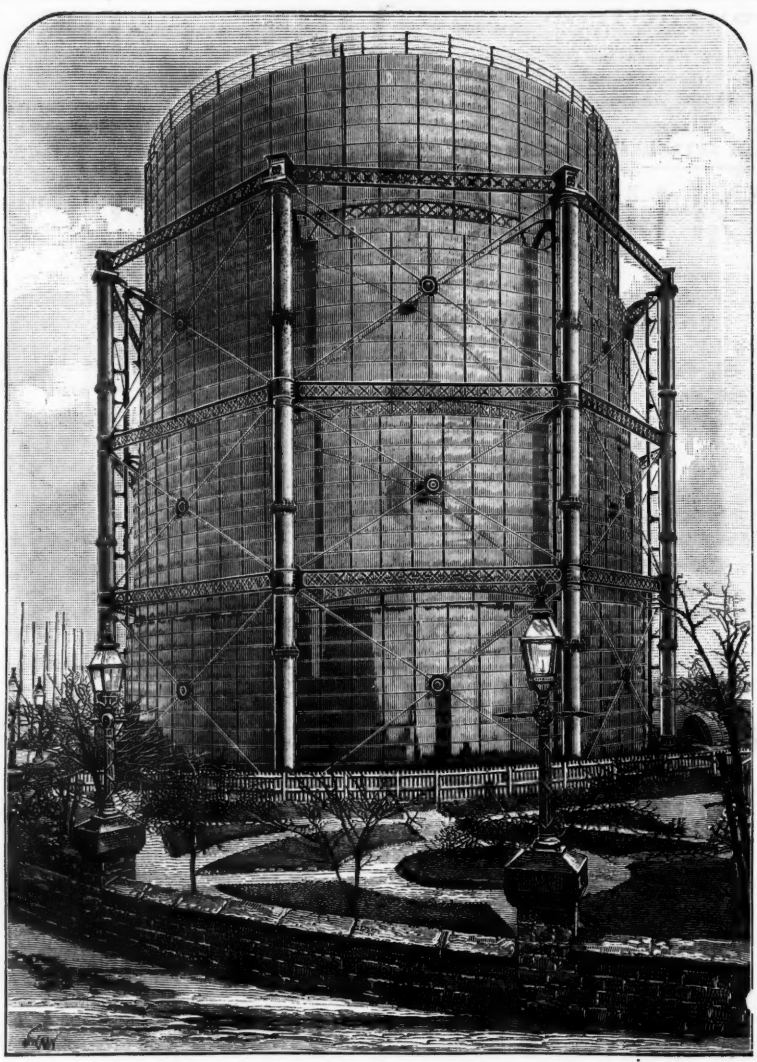

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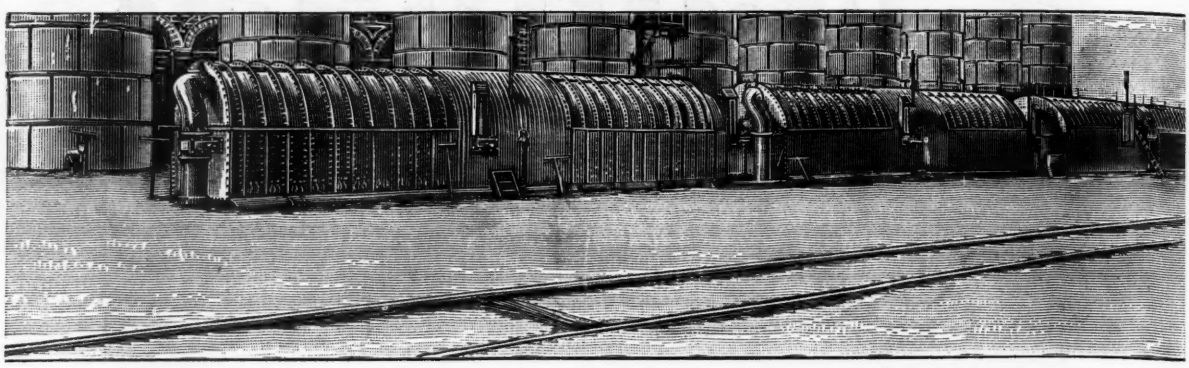

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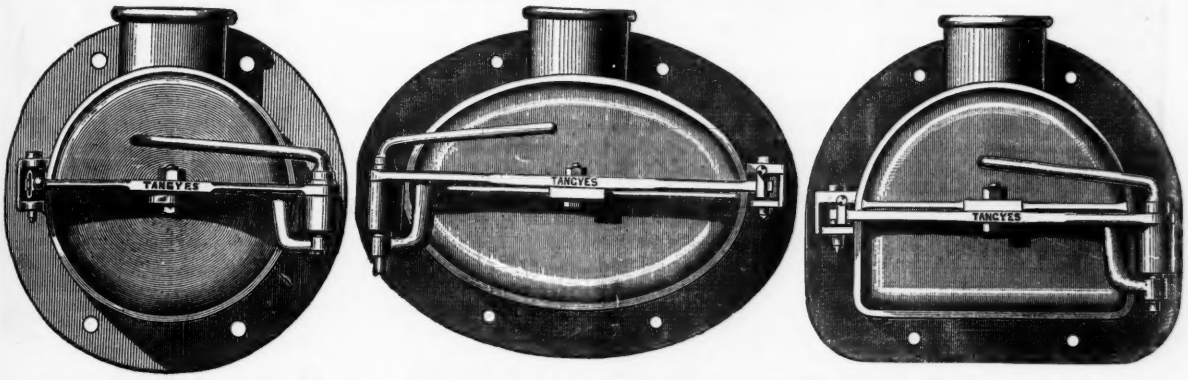

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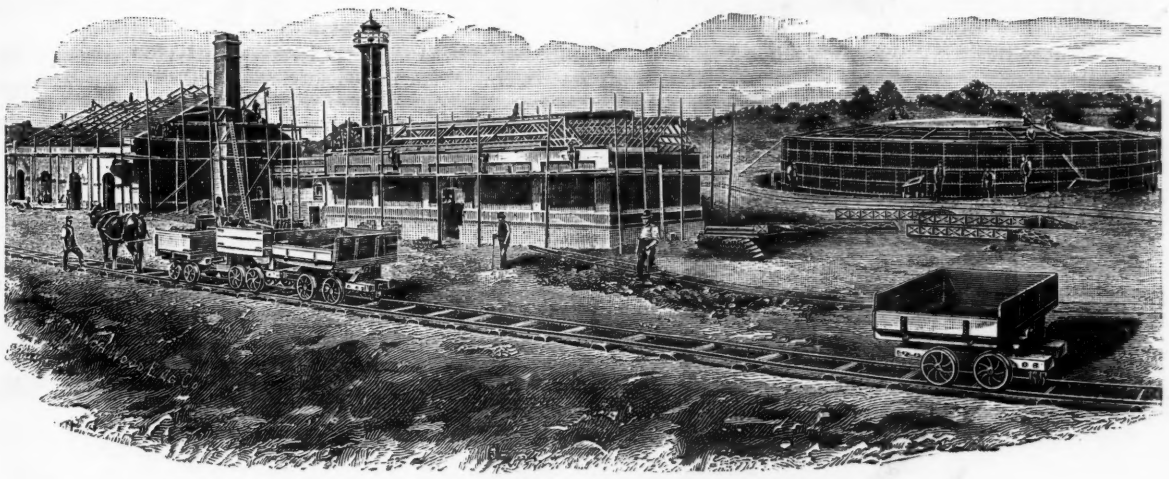

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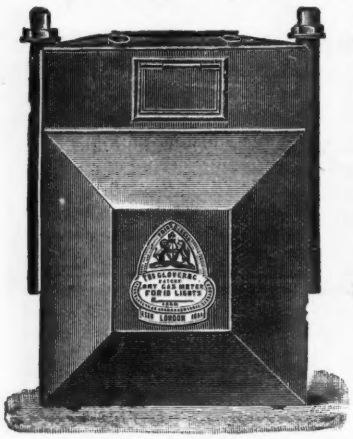

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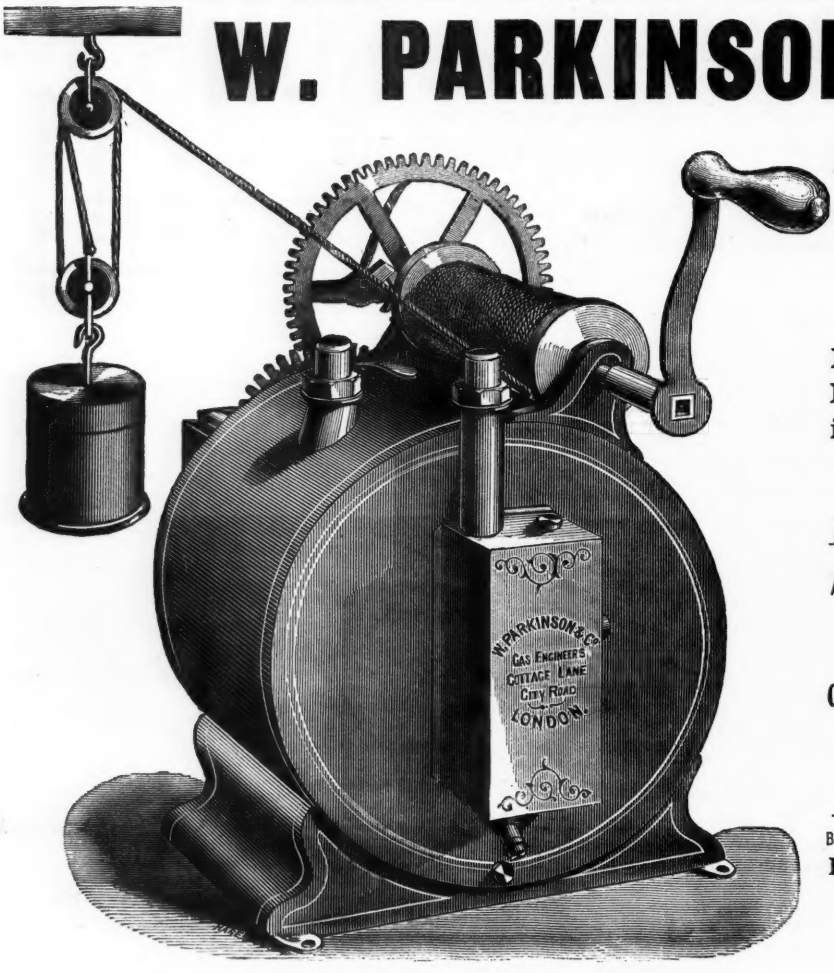

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[See also Advt., p. 176.

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
Mr. G. Livesey on London Gas . . . 143
A Progressive Gas Bill for Plymouth . . . 144
The Lighting of Street Lamps . . . 144
The Miners' Federation Conference . . . 144
WATER AND SANITARY AFFAIRS—
The London County Council (Water) Bill before the Examiner on Standing Orders . . . 145
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 146
Electric Lighting Memoranda . . . 146
Water Bills for 1894 . . . 147
NOTES:—
The Sweating of Coke . . . 148
The Origin of Anthracite . . . 148
The Transformation of Mechanical Force into Chemical Energy . . . 148
The Bacterial Purification of Water by Sand Filtration . . . 149
The Animal Origin of Petroleum . . . 149
TECHNICAL RECORD:—
The Holder Cup in Practice and in Theory. By W. E. M'Kay . . . 150
Gas-Engines for Driving Tramcars . . . 152
CORRESPONDENCE:—
The Peebles Oil-Gas Process and the Huddersfield Oxy-Oil Plant . . . 154
PARLIAMENTARY INTELLIGENCE:—
Examiner's Room, House of Commons—London County Council (Water) Bill . . . 154
LEGAL INTELLIGENCE:—
Isle of Wight Petty Sessions—The Assessment of the Ventnor Gas and Water-Works . . . 156
MISCELLANEOUS:—
The Quality and Testing of London Gas—The *Daily News* and Mr. George Livesey on the Question . . . 158
The Gas Question in Dublin—Alderman Gill Defends the Company; Mr. Mayne Defends the Corporation Gas Examiner . . . 160
Manchester Corporation Gas Supply—The Proposed Extensions at the Gas-Works . . . 161
The Wigan Out-Townships and the Price of Gas . . . 161
Mr. B. Pickard, M.P., on Work and Wages in the Coal Trade . . . 162
Important Improvements in the Leeds Water Works . . . 162
Artesian Wells as a Source of Water Supply . . . 163
Notes from Scotland . . . 164
Current Sales of Gas Products . . . 165
Coal Trade Reports . . . 165
Gas and Water Companies' Stock and Share List . . . 166

PARAGRAPHS.—The Directorate of the City of Waterford Gas Company, 145—The Gaslight and Coke Company, 148—Death of Mr. C. H. Parker, 148—Presentations to Bolton Gas Workers, 148—Increased Use of Oil Gas, 148—Death of Mr. W. J. Moon, 148—The Management of the Scarborough Gas-Works, 149—The Brookline (Mass.) Covered Reservoir, 149—The Petroleum Fields of India, 149—Underground Conduits in New York City, 152—Fires Caused by Accidents to Oil-Lamps, 153—Professor Lewes's University Extension Lectures on the Technology of Coal Gas, 153—Extension of the Rhyl Water-Works, 154—Water-Works for Lostwithiel, 154—Public Lighting of Mexico, 154—The Kettering Local Board and the Water-Works, 154—Pará Gas Company, Limited, 154—The Public Lighting of Liverpool and the Increase in the Price of Gas, 154—Extension of the Leamington Water-Works, 155—The Newcastle-under-Lyme Corporation and Payments from Gas-Works Loans, 155—The Pretended Meter Inspector, 155—St. Helens Gas and Water-Works, 155—Reduction in the Price of Gas at Rawmarsh, 157—The Position of the Dublin Water Supply, 157—Explosion at the Blackpool Gas-Works, 157—The Prospective Position of the Newcastle and Gateshead Water Supply, 157—The Proposed New Powers for the Torquay Gas Company, 157—The Rochdale Water Committee and Lead-Poisoning, 159—The Proposed Subways at Bolton, 162—Haslingden Corporation and the Gas-Works, 164—Fatal Paraffin Lamp Accident, 164—The Accident at the Blackfriars Electric Light Station, 164—An Extraordinary Accident to a Gas-Lamp, 166—An Explosion of Gas Caused by a Steam-Roller, 166—The Quality of the Gas at Leeds, 166—Damages for an Accident at the Crystal Palace Gas-Works, 166—The Agitation for Cheaper Gas in London, 166—Sales of Shares, 167.

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THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 23, 1894.

Mr. G. Livesey on London Gas.

IN view of the importance of the subject, not merely to the manufacturers and consumers of London gas, but also to the gas industry and the gas-consuming public at large, we reproduce in another column the whole story of the brief controversy between the *Daily News* and Mr. George Livesey respecting the testing and the value of the carburetting of the gas supplied in the Metropolitan area. We dealt with the *Daily News* article last week; and we desire now to refer mainly to Mr. Livesey's reply to this gratuitous attack upon the good faith of the London Gas Companies. As might have been expected, Mr. Livesey denies that any scheme for reducing the standard illuminating power of the South Metropolitan or any other London Company's gas has been brought before the Board of Trade. But he freely admits having stated publicly that the enrichment of ordinary coal gas costs the consumer more than it is worth to him, even when the gas is used for lighting only; while when it is used for any other purpose this outlay upon enrichment is a dead loss to the consumer. His contention, now repeated, is that the standard of illuminating power of London gas, has, by mistake, been fixed too high, and that the truest economy for the consumer would be found in the best gas obtainable without any enrichment from the available supply of coal, which for London is the coal of Durham, yielding about 15-candle gas. This view, we now learn, has been set out and explained in a Memorandum, which, "should the "opportunity arise, is to be put before the authorities;" but its nature is not to be laid bare for discussion in the first place in the newspapers.

It should be intelligible, even to the general public, that the cost of gas enrichment falls upon the consumer, inasmuch as it is an element of the cost of manufacture, which must be provided for as a first charge upon the revenue account. It should not be difficult to lead newspaper readers to understand that this enrichment is a superstitious observance, handed down from times when gas was never used for anything else than lighting, and when the appliances at the disposal of the consumers for this purpose were of a poor and imperfect character. It is absolutely immaterial, to the user of gas for cooking, heating, or generating motive power, whether it is rated as of 15 or 16 candles; and it matters little more to the consumer of gas in the improved modern burners which are now employed by the public in large and ever-increasing numbers. We should not like to commit ourselves to any positive statement of how much the candle or candle-and-a-half which is now added to London gas in order to make it pass muster at the testing-stations actually costs, directly and indirectly. That it does cost the people of London a considerable sum yearly need not be proved by argument; and Mr. Livesey is not single in believing that this money is as good as thrown away.

Mr. Livesey's explanation of the reasons for the strong objection which is entertained by the Companies to that pet of the old Metropolitan Board of Works and the London County Council, the portable photometer, is temperately expressed. But the *Daily News* waxes angry over the point, and spits out its belief in what was only hinted at in the first article—that the Gas Companies contrive to supply the consumers with gas of lower quality than that sent to the testing-stations. Mr. Livesey states that the portable photometer is "as unreliable "as it is illegal." Knowing, naturally, more about this subject than the Chairman of the South Metropolitan Gas Company, the *Daily News* scribe flatly contradicts him, and declares the instrument to be "perfectly legal and absolutely trustworthy." It is the newspaper idea that "it "is legal for the County Council, or for anybody else, to "test the quality of the gas supplied to the public in any "way they think proper"—a definition which, if included in the next General Purposes Act of the London County Council, would doubtless save a great deal of trouble to the Referees. It would be difficult to find a finer example than this of the habit of random assertion and pretence of judging without knowledge which vitiates so much of the newspaper writing of the day. Of course, Mr. Livesey did not allow this nonsense to pass unchallenged, but protested against the unfairness of telling the public that the Gas Companies do not fulfil their legal obligations, when the results of the legal tests show that all the statutory requirements are complied with. In connection with these observations, attention may be drawn to the notable report of Dr. Williamson on the gas supply of London during the past quarter which appeared in our last issue. Not in a single instance did the gas fall below the standard of illuminating power, although the fact was perfectly well known that, owing to the neglect of the Gas Referees to prescribe candles for the testing-stations, no penalty for defective illuminating power could have been recovered. In all respects, therefore, the past quarter's return is a "feather in the cap" of the Companies, of which they may well be proud.

A Progressive Gas Bill for Plymouth.

In our customary abstract of the contents of the Gas Bills for the ensuing session, the statement of the proposals of the Plymouth and Stonehouse Gaslight and Coke Company bulked largely; and, in view of the importance of the precedent which will be created if this measure becomes law in its present shape, it is expedient that we should make further reference to the Bill here, in order that the attention of Gas Companies generally should be engaged for it from the outset. In the first place, the Bill is noteworthy as being the only instance for the year of further development of the principle already legalized in the cases of the Bristol and the Crystal Palace District Companies—the consolidation of a Gas Company's capital upon what may be characterized as the matter-of-fact basis of a 5 per cent. dividend. There is ample ground for the statement that in both these examples the change has been advantageous, and has fully justified the expectations of those who initiated and sanctioned it. It is not putting the benefit too high to assert that this alteration of the denomination of the capital stock of two very ordinary Gas Companies has resulted in an economy of 10 per cent. in the cost of the stock. Argue the point as one may, it is practically impossible to obtain as good a price in the market for stock bearing dividends after the rate of 10 per cent. and upwards, as a 5 per cent. stock of equal intrinsic value readily commands. To put the point in another way, experience shows that original gas stock has to bear an extra cost, for reassuring the investor's mind, of at least 10s. per cent. as compared with equivalent 5 per cent. stock into which it is convertible by a simple financial operation. Moreover, the unwieldy lots into which a high-priced gas stock must be divided when it is desired to place it with consumers, workmen, and small investors generally, constitute a real obstacle in the way of this new movement in gas finance, which is upon all grounds so deserving of encouragement. For these reasons, which do not by any means exhaust the case for consolidation, the Plymouth proposal is likely to receive sympathetic treatment both by the Local Authorities and a Parliamentary Committee.

It so happens, however, that the capital of the Plymouth Company is subject to the sliding scale, which, with the auction clauses, was imposed upon the undertaking in 1879; the initial price being 2s. 6d. per 1000 cubic feet. At the same time, the share capital was increased to a total of £155,000, made up as follows: Original 10 per cent. shares to the amount of £25,000; old 7½ per cent. shares to the amount of £70,000; and additional 7 per cent. shares to the nominal amount of £60,000. The loan capital is £35,000. The paid-up capital is stated in the preamble of the Bill as amounting to £135,000; but this part of the Bill is not so clear as could be desired in a full statement of the Company's financial position. At any rate, it is obvious that here are three denominations of capital to be dealt with, bearing respectively dividends commencing under the sliding scale at 10, 7½, and 7 per cent. According to the last parliamentary return as to statutory gas undertakings, the dividends paid for 1892 upon these classes of capital were respectively 12¼, 9¾, and 9 per cent. It is proposed by the Bill to convert all these shares into £210,000 of ordinary stock, bearing a uniform standard 5 per cent. dividend, whereof £50,000 is to be divided among the holders of the 10 per cent. shares, £112,000 is to be apportioned to the holders of the 7½ per cent. shares; and £48,000 is to be divided among the holders of the 7 per cent. shares. The price of gas is 1s. 9d. per 1000 cubic feet; and the Bill proposes to re-enact the initial price of 2s. 6d. per 1000 cubic feet with a rise and fall of dividend of one-eighth of one per cent. for a penny. It is an interesting exercise to work out the incidence of the nine-eighths per cent., which the reduced price of gas actually gives to the owners of the undertaking, as between the different classes of share capital. It has long been understood that the issue of 7 per cent., or, in a few cases, of 7½ per cent. capital under sliding-scale conditions designed for 10 per cent. capital was a blunder; and the point is certain to be discussed with much emphasis in connection with these proposals. This is not the time to comment upon the subject in any sense; but we desire to keep in due prominence the problem presented by the Plymouth scheme. Generally speaking, the Plymouth undertaking is a good subject for the experiment about to be tried. The capital burden is exceptionally low; and the cheapness of the gas is a legitimate source of pride to the Board. By proposing to popularize their consolidated stock among their consumers and employees, the Board are now manifesting their competence to assimilate fresh ideas in gas finance, and are taking the surest way of identifying the interest of the undertaking of which they have the management with that of the public which it supplies with one of the first necessaries of town life.

The Lighting of Street Lamps.

It is a curious coincidence that the same week of the present month which witnessed our editorial comments upon the futility of devices for effecting the automatic lighting of street gas-lamps by putting pressure on the gas-mains (see *ante*, p. 60), should have seen the publication of an illustrated description of a device of this description in the columns of the *Electrical Review*. We referred to the fashion of such inventions as having belonged to a bygone period; but one never knows how often men will repeat themselves. It is really remarkable, however, that in these times a London electrical periodical should take the trouble to bring before the British public an illustrated description of an American device for automatically lighting gas-lamps. One would have thought, on general principles, that such a suggestion would not have the slightest attractiveness for an English electrician. It would have seemed much more natural if our contemporary had mentioned an invention of the kind merely to scout it as superfluous, seeing that street gas-lamps are so notoriously recognized as relics of a barbaric age which are only permitted to linger on in byways until such time as electricity shall be ready to supersede them. But the fact is, that the arrangement in question is set out, if not in terms of commendation, certainly without censure. Can this be significant of a turn of the tide? We should not like to push the incident so far as to draw an inference from it wholly out of scale with its obvious triviality. While mentioning the subject, it may be as well to repeat the warning that no arrangement for automatically lighting street lamps can be worth patenting; and this general condemnation applies especially to those in which alterations of gas pressure in the mains constitute the motive power. Gas-mains are not pneumatic tubes; and they can only be used in this way to a very limited extent under exceptional conditions. Being an electrical apparatus, the particular device reported upon by our contemporary is, of course, excessively simple, and not likely to get out of order; comprising as it does only, for every separate lamp, two sal-ammoniac batteries, a spark coil, an underground receptacle, a miniature gasholder accurately counterpoised, an automatic gas lighter, and a few other odds and ends. It is enough to point out, however—without reflecting on the truth that the more things there are to any arrangement, the greater the liability to break down—that the responsibility of providers of street lamps of any description is for lighting them at the proper time. It is not enough to press a button in some office far removed from the scene of the desired lighting, and trust to Fate and circumstances for the due result to materialize. The actual cost of street lamp lighting and extinguishing by hand is a trifle, considering that for it the whole district is perambulated twice in every 24 hours; thus enabling a watch to be kept up not only over the street lamps, but over everything in connection with the service of distribution. We freely acknowledge that it is very kind of the electricians to try and help gas managers in their work; but really they had better attend to their own affairs.

The Miners' Federation Conference.

During the past week the Annual Conference of the Miners' Federation has been going on at Leicester, under the presidency of Mr. B. Pickard, M.P., supported by Mr. S. Woods, M.P.; and the attendance of delegates is reported to have been large. The members of these conferences, or congresses, of Trade Unionists take themselves very seriously; and the fact of their thoroughly enjoying these meetings may be regarded as proved by the frequency of their recurrence, for it appears to newspaper readers that these affairs are always taking place somewhere or other. There can be no questioning the power of the Miners' Federation to make itself felt in

connection with the coal-mining industry of the country, but the precise nature of the link between the platform performances of the chief officials of this organization and its operations round the pits' mouths is doubtful. All these Trade Union officials talk in public in the same strain. Their professed aims are always of a blameless cast; and they will spend day after day in discussing and passing resolutions upon abstract questions which hurt nobody. There is a marked similarity between the transactions of these democratic assemblies and the "business" that occupies the House of Commons on private members' days. As with Parliament, however, so it is with a congress of Trade Union delegates—the actual government of affairs is kept altogether apart from the talk. Thus it is all of a piece with the dignity of his office and the importance of the Conference that Mr. Pickard should deliver a Presidential Address occupying a couple of newspaper columns in the report, and dealing with such matters as the Eight Hours Bill, the Nationalization of Mines, and the Rosebery settlement. But what one would prefer to hear would be a full, true, and particular account of the part taken by the Federation managers in such matters as the South Wales affair. Mr. Pickard and all his colleagues can play at holding a Parliament of Labour as well as anybody; but they do not say a word about the particular workings of the Federation which are the issue of secret counsels. With this consideration well in mind, it is interesting enough to follow what the Leicester conference did publicly. That they passed resolutions in favour of pressing the Government to take up a decided Trade Union programme, yet with due regard to the preservation in office of the present Administration, is only what might well be expected of an assembly led by men who have been classified as "party "items." Mr. Pickard's address contained some noteworthy passages, as, for instance, his comment upon the opponents of the Employers' Liability Bill, which ran in these remarkable terms: "All he could say was that any "employer of labour who desired to put his workmen into "the position of part owners of his concern in one par-"ticular should go the full length, and make them "thoroughly responsible all round." At a first glance, this observation does not appear to apply very naturally to the subject-matter; and it is to be regretted that the point was not more elaborated. Upon the all-important subject of coal prices and wages, Mr. Pickard spoke plainly, and in a spirit with which it is impossible not to sympathize. He said: "They (the Federation) had made "up their minds that, having fought for and obtained a "living wage, they were not going to allow the middle-"man, the coalowner, or the commercial agent to bring "the wages down to the point they were at prior "to 1888." It is so far satisfactory to learn that the much-debated phrase of the "living wage" has been actually realized in the rates prevailing throughout the entire Federation districts. Here at least there is something to go upon; and nobody will be disposed to blame miners for determining to extricate their wages from the bad old position of being the most "squeezable" element of the cost of coal production. The Federation position, therefore, as defined by Mr. Pickard, is that "coal prices can be so arranged and maintained as to give "profits and wages equal to a living rate continuously." We sincerely hope that this is true. When Mr. Pickard came to review the influence upon the coal trade of the so-called monopolists, he became incoherent, as usual; but he returned to reason when he inquired why colliery proprietors should underbid one another for contracts which they had better be without. Mr. Pickard has not yet learnt the very obvious lesson of the connection between coal prices and gas rates, but still affects to regard gas manufacturers, whether commercial or municipal, as purchasers who can pay anything they please for their coal supplies. It is a pity that, while he and his colleagues were at Leicester, they were not given an insight into the principles governing the very excellent local gas undertaking.

The Directorate of the City of Waterford Gas Company.—Mr. R. Hesketh Jones, J.P., has been elected Chairman of the City of Waterford Gas Company, in succession to the late John Henry Sugrue, Esq., D.L., J.P., of Cork; and Mr. John Lynch, the Chairman of the Cork Gas Company, has been elected a Director of the Waterford Company.

WATER AND SANITARY AFFAIRS.

NON-COMPLIANCE with Standing Orders is the report of the Examiner (Mr. Campion) with respect to the London Water Bill of the County Council. A stumble on the threshold thus befalls the authority of Spring Gardens; neither is it a small matter which has tripped up the antagonist of the Water Companies. The Standing Orders Committee may not pronounce the objection fatal. In some way or other, the difficulty may be got over; but for the present the Water Bill is in peril. The point at issue is, whether the notice given of the Bill by its promoters was sufficient to describe its objects. The Bill itself proved to be a mysterious, though threatening, measure; but the notice which preceded it was still more obscure. Nothing was said as to how the money was to be raised wherewith to purchase houses and lands, together with other matters, except so far as might be guessed from the vague intimation that one purpose of the Bill was "to amend and "extend the provisions of the London Water Act, 1892." When the Bill appeared, its final clause was found to specify as follows: "Section 4 of the London Water Act, 1892, "shall extend and apply to the purposes of this Act." This section 4, so innocently referred to, provides that "all "costs and expenses of the London County Council in the "execution of this Act (except so far as they may be "otherwise provided for by this or any other Act) shall be "defrayed as payments for general county purposes within "the meaning of the Local Government Act, 1888." But "general county purposes" are simply defrayed by the half-yearly rates levied by the County Council over the entire Metropolitan area, including the City; and the dragging of this section into the London Water Bill would practically convert the capital expenditure under that measure into current expenses. Instead of a loan to be repaid in a series of years, there would be an immediate and direct charge on the rates. This is a form of local taxation which is certainly novel; its only merit being that it is utterly impracticable as applied to a scheme of any magnitude. Mr. Cripps, on behalf of the County Council, said that "a scheme of water-works" was not in the least degree contemplated, or to be found within the four corners of the Bill. He was not even sure that the powers sought by the Bill would enable the Council to go so far as to "provide a water barrel, and a horse, to bring the "water up." Yet we must suppose that the Bill was intended for some purpose or other; and the question arises as to the precise nature of the object in view. Mr. Cripps admitted that the Bill might enable the County Council to purchase water-rights "somewhere in the "country." We should be disposed to say "anywhere." A further statement made by Mr. Cripps afforded the information that "if at any time, after having purchased "lands, or rights, or water-works," the County Council were to introduce a Bill to enable them to supply water, that "would be a different matter;" and the whole question could then be discussed. The plan is peculiar. "Lands, rights, and water-works" are first of all to be purchased; and afterwards there is to come in a Bill for giving the public the benefit of the water. It is fair to ask, in the first instance, where the purchase-money is to come from; and the only answer is that it is to come out of the general county rates. The Examiner discreetly signified that specific notice ought to have been given as to the mode in which the money was to be raised; and, the mode having been discovered, it seemed inadequate for the purpose, as involving a possible expenditure "far in excess of anything contem-"plated by the Act of 1892." The ratepayers of the Metropolis are to be congratulated on the acumen displayed by Mr. Campion; and they might acknowledge, if they would, that, in this instance, they have been befriended by the Water Companies. The Act of 1892, it should be remembered, only enabled the County Council to introduce Water Bills into Parliament, and to make inquiries into matters relative to the Metropolitan Water Supply; the costs in the latter case not to exceed £10,000 in addition to the sum authorized in 1890. It was certainly never supposed that powers of this description were capable of being expanded into a basis sufficiently broad to sustain the financial structure required for the Bill of 1894. The pyramid may not stand on its apex.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 165.)

THINGS were certainly a little better during the past week on the Stock Exchange, and there was some recovery from the depression which marked its predecessor. The sinister forebodings with regard to railway dividends received an agreeable check when the Great Eastern announcement was made; and then a reaction from the previous despondency set in. The American Market also, after some of its usual fluctuations, took a somewhat decided turn for the better; and in the Miscellaneous Market there were also some symptoms of an improving tendency generally. At the same time, the choicer class of investment securities had its full share of attention. So that, all round, the week shows an improvement. The state of the Money Market would, in the opinion of many, have warranted a reduction being made in the Bank of England rate; but the Directors resolved to let it stand for another week at least. The Gas Market has been fairly active, and very firm. With so much money about waiting for investment, it offers a fine field for those in search of a 5 per cent. investment. Changes in quotation are numerous; and all but one are in the upward direction, while they embrace all classes and descriptions. In Gaslights, the "A" steadily pushed its way forward from 234 on the opening day to 238 at the close. The demand for the secured issues was well maintained; and the price of the "G" stock again rose. The Company will declare a 12 per cent. dividend (the same rate as the last), and will carry a clear £62,000 forward—a substantial improvement upon the figures of the last two half years. South Metropolitans were quieter, but still on the rise. Commercials were neglected; but quotations rose slightly, in obedience to the general tendency as dividend time approaches. Scarcely any business was done in the Suburbans and Provincials; and, except for an advance in Alliance and Dublin, no sign was made. Among the Continentals, the tendency was the same as in the previous week—*i.e.*, Union and European were very firm, while Imperial continued to fall away. Of the rest, the Australian Companies have made a further moderate advance, in sympathy with the improvement in their local affairs; and one or two of the South Americans have also risen. Water is in high favour; various incidents exercising a benign influence, among which the check which the London County Council Water Bill received on Thursday, as recorded in our "Parliamentary Intelligence," may be mentioned. All the Companies' stocks advanced.

The daily operations were: The Gas Market opened very quietly, and remained quiet all day; but the tendency was very good. Gaslight "A" rose 1. Lambeth Water also advanced 1. Tuesday's transactions were more brisk, especially in Gaslights. Continental Union preference rose 3; and Bahia, ¼. Wednesday was quieter; but prices held firm. The only change was a rise of ½ in Pará. New River Water rose 5. Thursday's business was mainly in the heavy issues; which mostly ruled firm. Sydney and Melbourne bonds advanced 1 each. Lambeth Water went up 5. Business on Friday was mainly in Gaslight issues. The "G" rose 3; and the "A," 1. South Metropolitan "A" and both Commercials gained 1 each; but Imperial Continental relapsed 1. In Water, Grand Junction and West Middlesex advanced 2½ each; East London and Lambeth 10 per cent., 2 each; Southwark "D," 1½; and Chelsea, Kent, Southwark ordinary, and Lambeth 7½ per cent., 1 each. Saturday was quiet, but firm. South Metropolitan "A" rose 2; and Alliance and Dublin, ½. New River also rose 2½.

ELECTRIC LIGHTING MEMORANDA.

The Recent Fatality at the Blackfriars Electric Light Works—An English Electrician's View of the Chicago Exhibition—An Electrical Controversy at Newport.

IT is an uncomfortable coincidence for the electricians that the adjourned inquest upon the man who was killed at the Blackfriars station of the London Electric Supply Corporation on the 12th of September last should have been resumed and concluded last week, when public attention had been drawn to the dangers of electrical distributing plant by the street accidents in Glasgow, London, and Bournemouth. The long delay in the proceedings before the Coroner was due to the inability of a man who was injured at the same time that the other man was killed, to attend and give his explanation of the occurrence. It appeared, singularly enough, from this evidence, that the man who was killed must have received his shock through the other man's body; yet the latter escaped a fatal injury. The jury took twenty minutes to consider their verdict; ultimately returning the death as accidental. In the manner of Coroners' juries, however, they gave expression to some opinions upon the circumstances conducing to the catastrophe; remarking that "had proper precautions been taken to provide the men with gloves, the fatality might have been averted." It had been stated in evidence that certain rules and regulations relating, among other things, to the use of gloves, were in operation at the station; but these were not printed. This, the jury naturally considered, should have been done; and they further regarded the second man, who was only injured, as not competent for his several duties. In commenting thus upon fatalities, Coroners' juries always take the shortest and most obvious views of the circumstances. In the case in point, it having been brought to their notice that the use of gloves might have prevented an "accident," they declare that gloves should have been worn. People who regard such fatalities from a more distant standpoint than that of a Coroner's jury charged with the investigation of a particular instance, will probably conclude that reliance upon such a makeshift protection as an india-rubber glove is not to be encouraged in the men who have to do with electrical apparatus capable of dealing a deadly shock. There is something that strikes the imagination as peculiarly dreadful in the existence in a workshop, such as an electricity generating station really is, or in the streets of a town, of harmless-looking bars, wires, and knobs of quiescent metal, to touch which with the naked hand is sudden death. There is nothing to warn those sentinels of the human body, the senses, of this lurking danger; and momentary carelessness, inattention, or inadvertence will continue to carry doom now and again wherever charged conductors can by any means be brought into contact with the person.

An interesting article entitled "Some Lessons from the World's Fair" recently appeared in the *Electrical Review*, which will not afford pleasure to American readers of English technical periodicals. Thinking to see at Chicago a very large and interesting exhibition of electrical engineering appliances and inventions, our contemporary sent out a Special Commissioner to report in the fullest manner upon all novelties which might not have before been described—only, however, to be disappointed with the result. It is suggested that this feeling must have been shared by the Exhibition authorities themselves. The Commissioner found that much of the space in the Electricity Building was either empty or was occupied by exhibits not connected in any way whatever with electrical science or art. "The big American electrical manufacturing companies had been allotted numerous large spaces; but these were filled up with very ordinary dynamos and motors, and other plant and apparatus, among which there was little or nothing new, interesting, or instructive to a European electrical engineer." This is a sweeping condemnation of the electrical aspect of the Exhibition; but it is only summing up what has been said of the show many times. An exhibition, however, may serve a good purpose in the commercial sense, even if it does not contribute anything towards the progress of science; and our contemporary admits that thousands of American visitors to the Electricity Building in Jackson Park probably found its contents highly interesting. The collection, if not very great, was at any rate big; and it thus satisfied the native craving. Bigness was certainly the leading idea of the American exhibitors—"they had the biggest number of arc and incandescent lamps, and the biggest electrical railway ever used at an exhibition." Only in one thing it was not big, and that was as an exhibition of the science and art of electricity and electrical engineering. And somehow the bigness of the show did not exert all the effect expected; for it is remarked that, despite the huge display of the largest Company in the States, its shares fell immensely in value during the Exhibition period. Notwithstanding the wide field that exists in the States for electrical enterprise, and the complacency of the public in taking kindly to appliances of this nature that would never be tolerated in other parts of the world, American electrical industries have for some time been suffering depression. The whole thing has been overdone; and the electrical business has experienced a sharp check. With regard to the conduct of exhibitors at Chicago, our contemporary has little that is favourable to say. So late as July many of the exhibits were not in place, and some were covered up. The attendance on stalls was insufficient, and at some circulars and illustrations could be obtained only by leaving an address to which they could be posted if deemed expedient. Many of the exhibitors seem to have lived in mortal fear lest by being too communicative they should "give themselves away" to their trade rivals. Altogether, therefore, our contemporary considers the Chicago Exhibition a failure, as a technical show.

Considerable amusement is to be derived from watching the performances of certain electricians who have taken up the only kind of central station work there is now to be had in the United Kingdom—the carrying out of orders for local authorities. Mr. Robert Hammond is far and away the most entertaining personage in this company. He is an individual who has in his time played many parts; but he has concluded, for the time being, to perform only in the capacity of Consulting Electrician. He began this at Coventry, where he did a "lightning change" from the part of Contractor to that of Consulting Engineer; and he is just now endeavouring to secure a similar engagement at Newport. It so happens, however, that Messrs. Crompton and Co., Limited, have underbid Mr. Hammond and his associates, Messrs. John Fowler and Co., Limited, for the Newport job; and the former are not at all disposed to stand aside and see the Newport people pay their rivals £2000 more for an electric lighting plant than they have asked for the same things. Consequently, they are saying unkind things about the whole affair, and have so far succeeded in putting a spoke in the Hammond wheel that the matter of the tenders has been deferred until their representative has had an interview with the Committee. Crompton upon Hammond—what a title for an electrical polemic!

WATER BILLS FOR 1894.

THE following are the particulars of the Bills relating to water supply which have been deposited for the consideration of Parliament in the ensuing session.

The Ambleside District Gas and Water Bill is to incorporate a limited Company formed in 1866. The water supply limits are defined. Fresh undivided capital to the amount of £13,000 is to be raised, and separate revenue accounts are to be kept for the gas and water undertakings. The existing water-works are situated in the parish of Grasmere, and consist of a dam and intake on the stream known as the Scandale Beck, a pipe-line, and a covered reservoir, which are to be continued. Rates for domestic supplies are to range from 8 to 6 per cent. on the annual value, subject to the usual conditions. The Chesterfield Water-Works and Gaslight Company's Bill is to enable the Company to raise £100,000 of additional 5 per cent. capital, carrying the usual borrowing powers; and to enlarge their water-works by the construction of an impounding reservoir on the River Hipper, to be situated partly in the parish and township of Brampton, and partly in the township of Beeley in the parish of Bakewell. A catchwater drain is also to be made in connection with a stream flowing near Hunger Hill and discharging into the same river; and a service-tank is to be constructed in the parish and township of Heath. Compensation water to the amount of 212,000 gallons per day is to be discharged into the Hipper; and all the works are to be completed within seven years. The limits of supply are to be extended, subject to the permission, in certain cases, of the Rural Sanitary Authority of the Chesterfield Union. Certain amended rates for domestic supplies are proposed, ranging from 10 to 7 per cent. on the yearly value, with one-third extra for supplies beyond the boundary of the borough of Chesterfield. Extra charges are to be levied for water-closets and baths, with 7s. 6d. for every horse, 10s. for every four-wheeled vehicle, and 6s. for every two-wheeled vehicle.

The Central Middlesex Water Bill is to authorize the Central Middlesex Water Company, Limited, to sell and transfer a portion of their undertaking to the Colne Valley Water-Works Company. The transferred area is described in a schedule, and shown on an Ordnance map which is to be signed by the Chairman of the Committee. The amount of the consideration for the transfer is to be agreed upon between the two Companies. Certain lands and rights and a reservoir on Wembley Hill go with the severed portion of the undertaking. Power is sought for the limited Company to take water by contract from the Colne Valley, the Grand Junction, and the Rickmansworth and Uxbridge Valley Companies; and also to sell portions of the undertaking to the same Companies.

The Consett Water-Works Bill contemplates an enlargement of the Company's limits of supply, and the acquisition of part of the district of the Weardale and Shilton Company. Additional 7 per cent. capital to the nominal amount of £225,000 is required, with borrowing powers to the extent of £56,250. Lands are to be acquired within five years; and within fifteen years new water-works are to be constructed, comprising an impounding reservoir upon the Eudon Burn in the parishes of Edmondbyers and Muggleswick, a second reservoir upon the Feldon Burn, a third reservoir upon the Hisehope Burn, and a service-tank in the township of Tanfield in the parish of Chester-le-Street, with the usual subsidiary works. Common lands to the extent of not exceeding 177 acres are to be taken; and compensation water is to be discharged in stated quantity from all the reservoirs. The East London Water-Works Bill is to authorize the issue by the Company of debenture stock to the amount of £500,000, to bear 4½ per cent. interest; the money to be applied in stated proportions to different capital purposes. It is proposed that, after the expiration of three years from the issue of any such debenture stock, there shall be carried yearly to a sinking fund such percentage on the amount of the stock and premiums received thereon as shall be equal to the excess of the average percentage of the dividend or interest paid for that year on all the capital of the Company (whether share capital or borrowed money) above the interest, together with an additional 1 per cent. added thereto for management; such sinking fund to be held and applied by the Chamberlain of the City of London as Trustee for the purpose of purchasing and holding shares or stock of the Company, and of investing the dividends thereon with a view to ultimately extinguishing the capital, or for such other purposes as Parliament may from time to time determine. The new water-works proposed to be constructed, within seven years, comprise a storeage reservoir to be situated partly in the parish of Tottenham and partly in the parish of Walthamstow; a second storeage reservoir to be at the junction of the three parishes of Tottenham, Walthamstow, and Hackney; an enlargement of the Racecourse reservoir, in the parish of Walthamstow, by raising the embankment 9 feet; and an alteration of the line and level of the Copper Mill Lane. Certain provisions are inserted with reference to the use by the Company of Lammas Lands at Low Leyton, and a line of rails thereon.

The Newcastle and Gateshead Water Bill is to enable the Company to abandon the construction of a reservoir upon the River Rede, sanctioned by Acts of 1889 and 1890, and authorizing the construction in place thereof of a new and larger Catcleugh reservoir, to be formed by impounding the water of the same stream. Compensation water is to be discharged into the river course, in the minimum quantities of 4½ million gallons per day during the months of February, March, and April, and of 2 million gallons per day during the remainder of the year. The works are to be completed within ten years. Additional capital is desired to the nominal amount of £500,000, bearing a 5 per cent. dividend, with the usual proportionate borrowing powers. The Pontypridd Water-Works (Tramroad) Bill is to authorize the Company to construct a tramroad about 2½ miles in length, extending from the goods yard of the Taff Vale Railway Company at Maerdy, and terminating at a point on the Rhondda Fach River where the Company were empowered by their Act of 1892 to construct a reservoir. This work is necessitated by the absence of any available road in this mountainous district for the conveyance of the machinery and materials required for the construction of the works. The tramroad is not to be fenced; but gates are to be provided to make good gaps where the road passes through fences or crosses a public road. Additional capital to the amount of £6000 is required for the purposes of the Bill. The Southend Water-Works Bill is to sanction the raising of £80,000 of 7 per cent. capital, with the usual borrowing powers. Additional lands are to be acquired within seven years, and new water-works constructed within fifteen years. These include two wells and punping-stations to be situated in the parish of Thundersley, and two others in the parish of Eastwood. The Company's limits are to be enlarged so as to include the parish of Thundersley. The South Hants Water Bill is to extend the limits of supply of the Company to several parishes, including that of Lyndhurst, subject to the consent in the latter case of the West Hampshire Water Company. Additional 7 per cent. capital to the nominal amount of £80,000 is required, with the usual borrowing powers. A clause is inserted with a view to authorize the Company, with the sanction of three-fourths of the votes of the shareholders present in person or by proxy at a general meeting of the Company duly convened for the purpose, to contribute towards funds for the benefit of persons in their employ. Permission is desired for the removal of fittings belonging to the Company from unoccupied houses; and also for entering into agreements with the owners of private water-works within the limits of supply for the acquisition of those works by the Company. A clause proposes that notices of charges to consumers shall be sufficiently authenticated if stamped with the name of a collector.

The Southwark and Vauxhall Water Bill declares in the preamble, among other things, that the Company are desirous of carrying out, with the least possible delay, works in connection with storeage, subsidence, and filtration, as suggested by the report of the Royal Commission. It is proposed to raise additional capital, in the form of 4 per cent. debenture stock, to the amount of £750,000. A like clause for the establishment of a sinking fund to that already mentioned in connection with the Bill of the East London Company is inserted in this Bill. It is further provided that steps may be taken, by consent of a three-fourths vote of a general meeting, for the consolidation of the Company's debenture stocks, in manner specified. It is desired to extend the limits of supply so as to include a small portion of the parish of Lewisham. New water-works are projected, comprising a service reservoir to be situated upon the boundary between the parishes of St. Giles, Camberwell, and Lewisham; another in the parishes of Sunbury and Hampton in Middlesex; and a "subsiding reservoir," with filter-beds and engine-house, in the parish of Hampton, having a superficial area of about 1,399,520 square feet. In connection with the last work, a private footpath leading from the Lower Sunbury Road to the River Thames is to be stopped up; and all the works are to be completed within seven years. It is proposed to increase the quantity of water which the Company are permitted to take from the River Thames by as much more "as they may require," subject to the proviso that they do not ask to be favoured in this regard beyond other Companies, and that the total quantity of water taken by the Metropolitan Water Companies collectively shall not reduce the flow of the river over Teddington Weir below 200 million gallons per day. The West Middlesex Water Bill is to enable the Company to raise £500,000 of additional capital by the creation and issue of 4½ per cent. debenture stock. It is proposed that no single lot of such stock offered for sale shall be of more than £500 nominal value; and that the premium capital shall only be applicable to extending and improving the works of the Company. The same sinking-fund clause that appears in the Bills of the East London and Southwark and Vauxhall Companies is inserted in this Bill. The authorized dates for holding the general assemblies of the Company are to be varied from the first Tuesday in the months of May and November to any day in the same months. Certain sections of the Companies' Clauses Consolidation Act, 1845, relating to stock, are to apply to the Company.

The London County Council (Water) Bill, the text of which was given in the JOURNAL for the 2nd inst., is a measure in which, as will have been noticed, the preamble bulks more largely than the clauses. The former part of the Bill recites that the County Council were empowered by their Act of 1892 to introduce Bills relating to the supply of water in the Administrative County of London, and within the limits of supply of the Metropolitan Water Companies. It is then stated that some of

the areas in Great Britain best adapted for sources of water supply have been already appropriated by the municipalities of the principal cities and towns, and that further applications of the same kind are from time to time being made. Then it is argued that, "whereas it appears that the means for the supply of water to London and the neighbourhood are inadequate, and that larger quantities of water than can now be legally obtained are required for that supply, and that if the River Thames and Lee (*sic*) are to be relied upon for the future water supply of London, considerable additions are necessary to the arrangements for storeage, filtration, and purification; and whereas it is estimated, in view of the probable increase in the population of London and the neighbourhood, that the existing sources of supply might at no distant period become inadequate, while the increasing population in the valleys of those rivers will render it increasingly difficult to maintain their water sufficiently pure and wholesome for drinking purposes"—it is expedient that the County Council should be authorized to purchase by agreement or take on lease (1) any lands, houses, and buildings or easements; and (2) any waterworks, wells, waters, or rights to take or convey water which they may think it desirable to purchase or take on lease with a view to the future water supply to London and the neighbourhood. This right of acquisition is supplemented by an equally sweeping right of sale. No financial, geographical, or other limitations to these proceedings are contemplated by the Bill.

The Gaslight and Coke Company.—The balance to the credit of the net revenue account will, subject to audit, enable the Directors of this Company to recommend the payment of a dividend for the past half year at the rate of 12 per cent. per annum; carrying forward a balance of £62,124.

Death of Mr. C. H. Parker.—We regret to learn of the death, on the 14th inst., at the early age of 23, of Mr. Charles Henry Parker, son of the Manager of the Oakengates and St. George's Gas Company, to whom he was assistant. Deceased was a general favourite; and much sympathy is felt for his relatives in their bereavement.

Presentations to Bolton Gas Workers.—At a meeting of the members of the Bolton and District Gas Workers' Association last Tuesday, two presentations were made. Mr. H. Higson, the Secretary, and Mr. E. Fisher, the Treasurer, have been appointed foremen at the Lum Street Works, and thus necessarily retire from their positions in connection with the Association. The members showed their appreciation of the services rendered by these two officials by presenting a silver watch and Albert chain to Mr. Higson, and a marble timepiece, with side ornaments to match, to Mr. Fisher.

Increased Use of Oil Gas.—As evidence of the extending use of oil gas, we are informed that during the past year 12 oil-gas works were erected by the Patent Paraffin Gas Lighting Company, Limited; making upwards of 70 works for producing gas on the Alexander-Paterson system. All these works are for the supply of pure oil gas of 60-candle power, with the exception of the one put up at Oban for enriching purposes. Of those erected during the past year, two were for the small towns of Ellon and Insch, in Aberdeenshire, both of which were formerly supplied from coal-gas works; and another was for Messrs. Archibald Orr-Ewing and Co., of the Levenbank Works, Jamestown, Dumbartonshire, for about 3000 lights, previously supplied with the Alexandria Company's gas. We understand that in all cases the works are giving the utmost satisfaction.

Death of Mr. W. J. Moon.—We regret to record the death, on the 15th inst., in his 56th year, of Mr. William James Moon, of Scarborough. Deceased was born in York, but spent his early life at Malton; and in 1862 he received the appointment of Manager and Secretary of the Malton Gas Company. He afterwards held for about two years a similar position in connection with the Scarborough Gas Company. In 1868 he became Manager of the Peterborough Gas Company; and during his tenure of this office, he superintended a complete renovation of their works. He left the Company's service in 1876 to return to Scarborough—receiving from the Directors a handsome testimonial. He was then for three years assistant to his father, who at that time had the management of the gas-works, and subsequently succeeded him. In 1881 he was made Secretary and Manager, and held this position until the close of the past year, when he was compelled to relinquish it on account of ill-health, from which he had suffered for some time. It may not be out of place to mention here that, since the late Mr. Moon's connection with the Company in 1876, the make of gas has doubled. Deceased was one of the oldest members of the Incorporated Gas Institute, having been elected in 1865; he was also a member of the Incorporated Institution of Gas Engineers. He leaves a widow, one daughter, and three sons, two of whom are in the gas engineering profession. At a meeting of the Directors of the Company held last Wednesday, a resolution was passed, expressing their sense of the loss which the Board had sustained by the death of Mr. Moon, and their appreciation of the "valuable services he rendered to the Company during a long period of years." The funeral, which took place on the following day, was attended by the Directors, officers, and a large number of the employees of the Company.

NOTES.

The Sweating of Coke.

Some observations on the sweating of coke have been communicated by Mr. W. N. Page to the *Engineering and Mining Journal*, of New York. Mr. Page refers to a series of examinations made by himself over a period of ten years upon different cokes, as showing that during the hot summer months dry coke, containing not more than 1 per cent. of moisture, drawn fresh from the ovens and loaded direct into tight box trucks, without any contact with water in the yard, and in complete absence of rain, will become saturated with water when the doors of the truck are tightly closed; while if the doors are left open no such result follows. In the case of a truck so loaded with coke drawn from a beehive oven at red heat, the doors being closed, at the end of a week water would be dripping from the bottom of the truck, and the coke would average from 5 to 10 per cent. of moisture; while in a similar truck, loaded at the same time, but the doors being left open and all other conditions the same, the coke would contain less than 1 per cent. of moisture. These observations being founded upon facts, what is the explanation? It is known that dry carbon, notably fresh charcoal, possesses the peculiar quality of condensing or quietly absorbing and combining oxygen and hydrogen into water; but in the case of the wet coke, while the oxygen can be accounted for, where does the hydrogen come from? Mr. Page asks if it is possible for sufficient quantities of this gas to be contained in the cells of the coke, and be given up so slowly as to diffuse with the oxygen in a closed truck, while escaping from an open one. Though Mr. Page cannot say that sweating does not occur with coke in winter, his attention has been more particularly directed to the phenomenon during dry and hot weather. A remarkable feature observed is that the moisture contained in the coke under such conditions seems in excess of its capacity for absorbing by immersion in water even for 24 hours. When the coke has lain in stock for some time, the sweating is less apparent, or is entirely absent. Ventilation certainly prevents it. In nearly every complaint made by purchasers of their consignments of coke arriving wet, it was found that the trucks had been tightly closed during transit.

The Origin of Anthracite.

The origin of coal and the causes that have operated to differentiate coal into dissimilar kinds, are frequently discussed by geologists. When conducting the first geological survey of Pennsylvania, Professor Rodgers surmised that the anthracite beds of the eastern part of the State had been coked upon the elevation of the Appalachian Mountains—that is, he suggested that the heat and pressure attendant upon the elevation of the Appalachian chain, acting most vigorously near the axis, had distilled and removed the volatile matter of the coal bed lying nearest to it. To adjust this theory to the increasing number of facts of observation, Professor Lesley added the supposition that the heat required by this hypothesis was brought up by conduction when the superincumbent rock masses were extremely thick, before they had been removed by erosive agencies during a long period of time. The inadequacy of these theories has led Professor J. J. Stevenson, of the University of New York, to propound another, which he recently explained and defended at a meeting of the Geological Society of America. According to this view, the lack of volatile matter in anthracite coal is due to the circumstance of its having been longer exposed to that kind of decay which takes place when vegetable matter is long immersed in water; consisting chiefly in the loss of the hydrocarbons which constitute the volatile element in bituminous coal. According to the Stevenson hypothesis the anthracite beds are merely those which were formed earliest in the swamps and lagoons of the carboniferous period, and remained longest devoid of the protective covering of sedimentary deposits, by which they were subsequently preserved from further change. This suggestion is supported by the negative fact that there is no such strict relation of the anthracite beds of Pennsylvania to the Appalachian axis of elevation as Professor Rodgers supposed to exist; as well as by other positive evidences which Professor Stevenson is about to make public. If the new hypothesis holds good, it will be welcomed everywhere as an intelligible solution of what has long been a mystery of geology, for it has not been easy to accept the standing explanation of the origin of anthracite—that it is bituminous coal that has been half-coked by cosmical means.

The Transformation of Mechanical Force into Chemical Change.

A remarkable series of experiments have been carried out by Mr. M. Carey Lea, with the object of ascertaining whether the effects of pressure upon certain substances could be made to yield the same results as light. Mr. Lea began by squeezing the silver haloids, and found these salts were readily blackened in this way, and so gave evidence of partial reduction. It was then tried whether the same agent—mechanical force—would be capable of bringing about analogous chemical changes in other compounds. These experiments differed fundamentally from the pressure experiments of Spring and Bullock, inasmuch as in the present instance the reactions produced are all endothermic. Energy is consumed in accomplishing them;

and this energy is supplied by mechanical force. The results of subjecting a large number of chemical compounds to heavy squeezing in Mr. Lea's apparatus, which was capable of exerting a pressure of upwards of a million pounds to the square inch, were highly encouraging. The darkening of colour was in many examples well marked. The same results were subsequently repeated with greater ease by the substitution of a shearing for a compression stress on the materials. Mr. Lea's general conclusion from his experiments is that mechanical force can bring about reactions which require expenditure of energy, such energy being supplied by mechanical force in precisely the same way that light, heat, and electricity supply energy for the endothermic changes brought about by these agencies. The converse transformation—that of chemism into work—is, from the industrial point of view, by far the greatest chemical problem now awaiting solution. It is by no means certain that such a transformation is practically possible. At least it seems probable, says Mr. Lea, that the improvement in our method of obtaining work from the chemism of carbon may be in the direction of substituting electricity for heat as the intermediary.

The Bacterial Purification of Water by Sand Filtration.

Some interesting experiments on the removal of pathogenic bacteria by sand filtration have been carried out by Mr. George W. Fuller, of Lawrence, Massachusetts, in connection with the water supply of that place. He first determined, as the result of long-continued investigations at the Lawrence experiment station, that the typhoid bacillus continues to live in the water of the Merrimac River at Lawrence, in greatly diminished numbers, for a period of at least 24 days. Other investigations of different water and under different conditions have shown the length of life of this germ as varying from 3 to 10 days. The duration of life of the cholera bacillus in various waters has been observed to be from two days to seven months. Modern hygiene demands that drinking water shall be free from pathogenic bacteria. Experience shows that a certain degree of bacterial purification is effected in the case of an unfiltered town supply by dilution, by storeage in a reservoir holding one or two weeks' supply, and by passage under pressure through miles of iron pipe. But this is not sufficient. The situation of many cities and towns obliges them to face the problem of removing the pathogenic bacteria from water which is or may at any time become polluted; and the Lawrence experiment station was established by the Massachusetts State Board of Health to determine, among other things, the sufficiency in this regard of sand filtration. An experimental filter-bed was constructed in 1887; and water of different degrees of contamination has been passed through it during the past four years. As a result, a mass of evidence was collected which goes to show that no bacteria pass through such a filter. The efficiency of filtration, as shown by 102 bacterial determinations between Nov. 14 and Dec. 31, 1891, was absolute in 58 instances; and of 186 determinations from May to October the average removal was 97·3 per cent. Of the bacteria in the effluent, it was found that all could be accounted for as identical with those in the air, the outlet pipe, and the under drains. Tests of sand filters subsequently constructed for the town supply have been made continuously by the application of an easily identified species of bacterium, and observing its passage through the tanks. The efficiency of removal averaged 99·48 per cent. These experiments were very much more severe than anything that could ever occur in connection with the pollution of water supply. Fairer tests were afterwards made, with the result that the efficiency of the filters rose to 99·87 per cent. Mr. Fuller's general conclusion, from five years' experimenting and 11,000 bacterial tests, is that "it is entirely practicable to construct filters which will purify water economically, and remove more than 99 per cent. of the bacteria in the unfiltered water."

The Animal Origin of Petroleum.

The problem of the origin of petroleum has been considered by many authorities in chemistry and geology, and the different theories that have been advanced on the subject may be divided into two orders—one comprising the suggestions which refer this product to reactions of inorganic materials; the other, those that suppose it to have an organic origin. The most important hypothesis of the former class is that of Mendeléeff, who assumes that water enters the interior of the earth by fissures in the crust, and, coming into contact with molten iron carbides, forms in the simplest manner iron oxides and fluid hydrocarbons. The peculiar attraction of this suggestion consists in its offering a continuous cosmical process for the production of petroleum, which would thus be inexhaustible. Dr. C. Engler remarks that while this theory is not open to strong objection from a chemical standpoint, the composition of the different kinds of petroleum does not support it. The idea has been entertained that petroleum was produced from vegetable remains by a kind of distillation process; but this is discredited by the absence of any connection between coal and petroleum deposits, which one would naturally expect to find if they had a common origin. According to a third theory, the remains of animals constitute the raw material from which petroleum is formed in the earth. Dr. Engler has nothing to say on the geological aspect of this suggestion; but he has experimented on the transmutation of animal remains into oil. He first of all distilled quantities of salt water fish and shells under strong pressure; the result being a liquid containing mostly nitrogenous bases, such as pyridin, which had no resemblance to petroleum. He then turned his attention to the fat, or adipocere, which remains after the putrefaction of all other animal matter. To test the chemical possibility, Dr. Engler first distilled train oil at a moderate heat under pressure, and found that, under favourable conditions, 70 per cent. of the oil was converted into petroleum. The same result was obtained with other animal fats and oils. Dr. Engler has indeed succeeded in converting fish oil into petroleum, from which he has isolated almost all the hydrocarbons which have been discovered in Pennsylvanian petroleum, including gas, burning oil, gasoline, and wax.

The Management of the Scarborough Gas-Works.—Our readers will infer, by the announcement which appears elsewhere of the death of Mr. W. J. Moon, of Scarborough, that some change has lately taken place in connection with the management of the Scarborough Gas-Works. Owing to Mr. Moon's continued ill-health, he retired from the active supervision of the concern at the close of last year; his services being, however, retained by the Directors as general adviser to the Company. He has been succeeded by the Sub-Manager, Mr. J. Holliday, Assoc.M.Inst.C.E., F.C.S., who had been discharging the duties of Secretary and Manager for the preceding three months. Mr. Holliday was a pupil of Mr. J. Hepworth, of Carlisle; and, on the completion of his articles, he became that gentleman's chief assistant—holding this position for three years. In December, 1891, he received the appointment with the Scarborough Gas Company from which he has now been promoted to the more responsible one he had temporarily filled.

The Brookline (Mass.) Covered Reservoir.—In a recent number of the *Engineering Record*, some particulars, with illustrations, were given of the Brookline covered service reservoir, completed some time ago, from the plans of Mr. F. F. Forbes, the Superintendent of the Brookline Water-Works, at a cost of $27,000. Its capacity is about a million gallons. The interior is 91 ft. 4 in. square at the bottom, and 94 feet square at the springing line of the arches, 17½ feet above the bottom. The piers are 2 feet square, and are built of brick laid in American cement mortar to a height of 15 feet, and above that in Portland cement. The arched lintels and covering arches, 10 feet in the clear, are also of brick laid in Portland cement concrete; and the concrete covering over the whole reservoir was made with Portland cement. When well set, the entire top surface was washed with coal tar, and sprinkled with fine sand. Lines of 1½-inch drainage tiles were laid in gutters in the concrete, and were extended through the walls round the reservoir. The walls were built of Roxbury stone laid in American cement mortar mixed with sand, in the proportion of 1 to 2, and were backed with puddle. In no case was a stone allowed to reach through the wall. The shorter walls were 4½ feet thick on the top, and 9½ feet thick at the bottom; while the longer walls were 3¾ feet thick on the top, and 8½ feet thick at the bottom. The foundations for the walls are made of 4 inches of American cement concrete; those for the rubble bases of the brick piers being 4-inch layers of Portland cement concrete, projecting 3 inches beyond the bases on all sides. The interior of the walls was plastered with a ½-inch coating of Portland cement mortar. The bottom of the reservoir is covered with 2 inches of puddle, over which is 4 inches of Rosendale cement concrete rounded up, where it joins the side walls, in a curve of 2 feet radius.

The Petroleum Fields of India.—At the Imperial Institute last Thursday, Mr. R. D. Oldham, A.R.S.M., delivered, in connection with the Indian Section of the Society of Arts, a lecture on "The Petroleum Fields of India: Their Present Condition and Probable Future." He said the operations that had been carried on in the provinces of Khattan, Rohri, Baluchistan, Mogalkol, and North-West Punjab had, for the most part, been unsuccessful; and he had come to the conclusion that but a very limited field of oil was to be obtained on the western frontier of India. In the East, the failure of the operations in Upper Assam, where the oil springs extend about 100 miles, was due, he thought, to want of skill on the part of the artificers employed, and a faulty selection of the sites for boring. The workings which were being carried on in the neighbourhood of the Digboi and Bapa pungs were most promising; and he was hopeful of an abundant yield from them. The time was yet to come when the coal and petroleum fields of Upper Assam, which were unsurpassed both for quality and quantity in the Indian Empire, would be opened and developed. Petroleum was known to exist on the southern margin of the Khasi and Garo hills; but the promise was not sufficient to justify the heavy expenditure that would be necessary. The only productive oil-field of the empire was in the newly-acquired province of Upper Burma, where the possibilities of the expansion of the petroleum industry depended largely upon the policy adopted by the Government. Two things were necessary: (1) A survey of the areas in Burma and Assam, in which oil was likely to be found; and (2) the promulgation of a set of rules for the granting of mining concessions. The lecturer did not anticipate India would ever rank with Russia and America among the great exporting countries of the world; but he thought the increase would be sufficient to provide for her own consumption.

TECHNICAL RECORD.

THE HOLDER CUP IN PRACTICE AND IN THEORY.

The following article on the above subject, specially prepared for the *American Gaslight Journal* by Mr. W. E. M'Kay, appeared in the number of that publication for the 11th ult.:—

There is no gas-valve so efficient as a water-seal. If kept filled with water to sufficient depth, no leakage of gas will occur; and there are very many places where it is impossible to employ any other means of making lines of contact absolutely tight. The water in the holder pit and in the holder cup effectively aids the easy variation of the stock of gas; but as every water-seal is a danger-line, so the multiplication of the holder cups, by the construction of three and of four lift holders, increases the necessity for care in the maintenance of the seals.

The original depth of the cup seal, as covered by the design of the constructors, is dependent upon the proposed pressure of the contained gas, with an ample allowance for the incidental or accidental loss of water from the cup when in actual use. Such losses will occur from evaporation, from leakage through the cup plates,* from the careening of the holder, or from the withdrawal of the water by an accidental syphon. Holders with many cups are now built uncovered; and, besides keeping the cup filled with water, it is important to prevent the formation of ice in the cup. In cold weather and in exposed locations, occasional heavy falls of snow add to the difficulty of keeping the cups in good order; the snow shovelled from the crown of the holder lodging in the cups, and chilling the relatively small quantity of water.

The two uncovered holders referred to in the following account are double-lift holders, 150 feet in diameter, and are so placed as to be entirely without shelter from wind or storm in any direction, while exposed to temperatures varying from 100° above down to 10° below zero. The depth of the cup is about 18 inches. The nearest point of the holders is about 400 feet distant from the boiler-house. Steam to the cups and pits is supplied through a main-pipe 2½ inches in diameter; this pipe being underground, covered with asbestos, and boxed without sawdust. This line is furnished with several sliding expansion joints. At the holders, the 2½-inch pipe is divided into two 1-inch pipes—one running three-fourths of the way round each holder, still underground. Four 1-inch pipes, symmetrically distributed and suitably valved, furnish steam to the pit water in each holder. Each cup is similarly supplied with steam through four ¾-inch pipes. The average temperature of the water in the cup in winter is not below 42° Fahr. In turning the steam on and off, the following is the general observance: With a falling thermometer—(1) No wind, turn on when outside temperature is 28°. (2) With west wind, turn on at 30°. (3) With high north or west wind, turn on at 34°. With a rising thermometer—(4) With south or east wind, shut off steam when outside temperature is 28° to 30°. (5) With light west wind, shut off at 32°. (6) With high north or west wind, shut off at 34° to 36°. When steam is on, the 2½-inch main-pipe has full boiler pressure and full valve opening. The adjustment of the temperature of the cup water is controlled by the regulating-valves at each small supply-pipe. Under the worst conditions of weather and outside temperature, the foregoing arrangement has adequately provided for steam supply. A careful watch of the weather and the water during the winter seasons has been found abundantly to repay the expenditure for labour in the recognized economy of coal consumption.

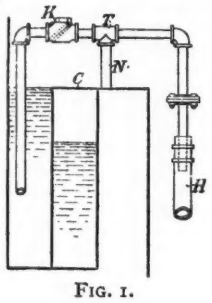

Fig. 1.

The ¾-inch steam-pipes for the holder cups are secured in the way shown in fig. 1. A solid nipple N is tapped into the cover-plate C, and furnishes support, by the fitting T, to the ¾-inch pipe. A check-valve (horizontal swinging) K is introduced, as shown, to prevent syphoning when the steam has been shut off. Connection is made with pliable rubber hose H, the other end of which is similarly fastened to the wrought-iron pipe carried up an adjacent holder column to a height equal to half of one lift. Each piece of hose has length equal to five-sixths of the height of one lift or section of the holder, and the hose bends in an easy U—readily accommodating itself to the height or motion of the holder.

The cupping or uncupping of the holder varies the level of the water in the cup. Observation having furnished me with practical information of this variation of level, a comparison was made with the changes that should occur according to computation; and there resulted the following theory of the movements of gas and of water in the holder cup, at various points of the rise and fall of the holder:—

(1) Suppose the holder cupped. The depth of the cup in question is 18 inches. A cross section would show the full width divided unequally into three parts by the several iron plates, somewhat as appears on the accompanying sketch (fig. 2). The diameter of the upper section is 150 feet; pressure, 3·2 inches; diameter of lower section, 152 feet; pressure, 4·7 inches. Then, when the holder is cupped, and the pressure is 4·7 inches, the volume of gas V_1 per unit of circumferential length is $4 \times 4{\cdot}7 = 18{\cdot}8$; the cup being full of water, and the holder standing true—*i.e.*, not tilted by wind pressure or by the guides. No account is taken of the space occupied by the iron division-plates. The volume $V_2 = 18 \times 4 = 72$, and $v_1 = V_1 + V_2 = 90{\cdot}8$. The volume of water W_1 per unit of circumference $= 13{\cdot}3 \times 4 = 53{\cdot}2$; $W_2 = 18 \times 2{\cdot}8 = 50{\cdot}4$; and $w_1 = W_1 + W_2 = 103{\cdot}6$. In the foregoing, V_1 is the volume of gas between the two intermediate iron plates; V_2 is the volume of gas between the two outer iron plates; W_1 and W_2 are similarly contained.

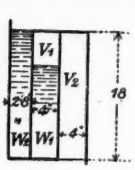

Fig. 2.

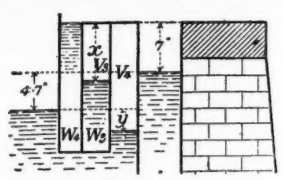

Fig. 3.

(2) The holder is falling, and the lower section almost rests upon, but just clears, the landing-stones; and the holder is ready to uncup. It is found that at this time (by observation) the difference of level between the water in the pit, when full, and the top of the cup plate of the lower section is 7 inches. As the holder falls, the gases V_1 and V_2 are shut up in the cup as soon as the bottom plate of the cup strikes the surface of the water in the pit; and as the cup descends into the pit water, these gases are compressed. But this increase of pressure is immediately relieved, in part, by an overflow of water from the cup. At the moment illustrated in the second sketch, the holder is still cupped, but is exactly at the point of beginning to uncup. The level of the water within the holder proper must be 4·7 inches lower than the level of the water outside the outer holder. Also (see fig. 3) let x equal the distance from the top plate of the cup to the surface of the water in the intermediate space, and let y equal the difference of level of the water inside the upper section shell of the holder proper, and of the water in the outer space of the cup. Then x equals the new water pressure that would be shown upon a pressure-gauge set upon the gas within the cup. V_3 and V_4 stand for volumes of gas in the same way as V_1 and V_2; W_3 and W_4 stand for volumes of water. Of course, the gases in V_3 and V_4 (similarly to the gas in V_1 and V_2) are under the same pressure, as the joint of the iron plate against the top of the cup cannot possibly be gas-tight. Also, as the joint of the iron plate upon the inside bottom of the cup cannot be water-tight, the water in W_3 and in W_4 is free to move in either direction, according to the variations of pressure. The ordinary atmospheric pressure of 30 inches on the mercurial barometer is equivalent to 408 inches of water pressure. Let p_1 = pressure of the gas V_1—see sketch under (1)—and let p_2 = pressure of the gas v_2, where $v_2 = V_3 + V_4$; then we have the following equations:—

$y + 4{\cdot}7 + 7 + x = v_2$, since $y + 4{\cdot}7 + 7 = V_4$, and $x = V_3$,
$p_2 = x + 408$, and $y = x - 4{\cdot}7$,

for the difference of level of the water under V_4 and of the water outside the gasholder must equal the excess of pressure of the gas v_2 over the atmospheric pressure. Also—

$v_1 p_1 = v_2 p_2$; $p_1 = 408 + 4{\cdot}7 = 412{\cdot}7$.

$v_1 = 18 + 4{\cdot}7 = 22{\cdot}7$ if the factor of width (=4) be disregarded; being the same in all the equations here considered.

Solving, $(2x + 7)\ (x + 408) = 9368{\cdot}29$; $x^2 + 411{\cdot}5\ x = 3256$ (omitting tenths); $x = 7{\cdot}8$ inches. Then $y = x - 4{\cdot}7 = 3{\cdot}1$ inches, and $x = V_3 = 7{\cdot}8$, and $V_4 = 14{\cdot}8$; $v_2 = V_3 + V_4 = 22{\cdot}6$, while $v_1 = V_1 + V_2 = 18 + 4{\cdot}7 = 22{\cdot}7$. By neglecting the factor of width (as above explained), the direct comparison of the volumes of the gases is greatly facilitated, and the algebraical computations are made more simple, while the final results remain unchanged.

$v_2 - v_1 = -0{\cdot}1$, and $p_2 - p_1 = 415{\cdot}8 - 412{\cdot}7 = 3{\cdot}1$.

$3{\cdot}1 \div 412{\cdot}7 = 0{\cdot}007512$, and $1 \div 227 = 0{\cdot}004405$;

showing an apparent discrepancy in changes of volume and of pressure; but this discrepancy is not real, as it occurs in consequence of disregarding very small fractions of pressure.

* It may be pointed out that the term "cup plate" in England means the vertical plate between V_1 and V_2 (see fig. 2); whereas the author applies it to the top horizontal surface of the "grip." Other terms employed in the paper, although not those which are customary in England, do not interfere with the author's meaning. In connection with Mr. M'Kay's article, our readers' attention may be called to the translation, by Dr. W. Pole, F.R.S., of M. Arson's well-known paper on "Gasholder Construction," which appeared in the Journal early in 1877 (see Vol. XXIX., pp. 12, 49, 84, 121); and also to the translation of MM. Monnier and Thibaudet's paper, entitled "A Study on Gasholder Construction," which will be found in Vol. XXXVII., pp. 562, 606, 666, 694, 742, 783. It will be seen, on comparing these with the article, that certain points drawn attention to by the writer had been already noticed.—Ed. J.G.L.

Using the factors of width, we have—

$$W_3 = 10{\cdot}2 \times 4 = 40{\cdot}8;\ W_3 + W_4 = w_2 = 91{\cdot}2.$$
$$W_4 = 18 \times 2{\cdot}8 = W_2 = 50{\cdot}4;\ w_1 - w_2 = 103{\cdot}6 - 91{\cdot}2 = 12{\cdot}4 = Q_1;$$

showing that a quantity of water nearly equal to 12·4 cubic inches for every inch of the circumference of the cup must have overflowed from the cup into the pit. As, in the above calculations, the difference of diameter of the several shells of the holder has not been taken into consideration, if we use the average diameter of 151 feet to compute the average circumference, the total quantity of the overflow is, in gallons—

$$Q_1 = \frac{151 \times 12 \times \pi \times 12{\cdot}4}{231} = 305{\cdot}6 \text{ gallons.}$$

In other words, as will be shown later, more than 300 gallons of water of condensation could thus be forced from the cup into the outer pit every time the holder uncupped.

(3) The next case considered is that when the lower section of the holder rests upon the landing-stones, but the upper section has not fallen farther, so that no change whatever from that described in the second case has occurred in the relative positions of the several parts of the holder shells. The difference of level of the waters within and without the holder is now 3·2 inches—the so-called "pressure of the upper section." The area (A_1) of the surface of the water within the holder is to the area (A_2) of the surface of the ring of water between the holder wall and the masonry in the ratio $\frac{A_1}{A_2} = \frac{5625}{153} = \frac{37}{1}$. Therefore, it is evident that, by this change of the difference of levels from 4·7 inches to 3·2 inches, a change of 1·5 inches is accomplished by an apparent change of very nearly 1·5 inches in the level of the ring of water outside the holder. The diagram fig. 4 shows the change described. It is effected by withdrawing gas from the holder so that the gas pressure falls from 4·7 inches

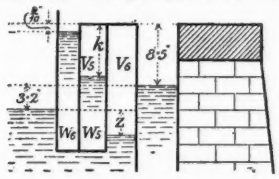

FIG. 4.

to 3·2 inches; allowing the weight of the lower section to rest upon the bottom of the holder pit. The reduction in the volume of the gas contained in the holder is small, and in cubic inches is nearly equal to $(1{\cdot}5 \div 37) \times A_1$, where A_1 is expressed in square inches. The correct expression for this reduction in volume, in cubic feet, is $\frac{1{\cdot}5 \times \pi \times 153}{12} = 60{\cdot}08$. As the upper section of the holder, when full, has a capacity of 576,000 cubic feet, it appears that the change of 1½ inches of pressure occurs with a change in volume of approximately 1-100th of 1 per cent., or 1-10000th of the total capacity of the section. The quantity of gas withdrawn, however, is different from 60·08; being equal to 578,160 − 576,000 = 2160 cubic feet at 3·2 inches pressure, where—

$$578{,}160 = \frac{412{\cdot}7}{411{\cdot}2} \times 576{,}000$$

This gives an idea of the rate of change of pressure, or of the time of uncupping, when the rate at which gas is passing out of the holder is known. For instance, if 150,000 cubic feet per hour are leaving the holder, the whole time of uncupping takes less than a minute.

Referring now to the gas, $V_5 + V_6 = v_3$, confined within the holder cup; this is under new conditions. As the tension of the gas within the holder proper has decreased by 1·5 inches, the gas v_3 is under a new pressure p_3, 1·5 inches less than p_2. Then the difference of level of the water, W_5 and W_6, must be 1·5 inches less than before (W_3 and W_4), and equals 7·8 − 1·5 = 6·3 inches; and this change of level lowers the water in W_6 by 0·9 inch—raising it in W_5 by 0·6 inch—on account of the ratio of the several divisions of the cup. $v_3 p_3 = v_2 p_2 = 9368{\cdot}3$; $p_3 = p_2 - 1{\cdot}5 = 415{\cdot}8 - 1{\cdot}5 = 414{\cdot}3$ inches. Then $v_3 = 9368{\cdot}3 \div 414{\cdot}3 = 22{\cdot}6 +$ (showing no appreciable change in volume). But $V_5 = 7{\cdot}2$ (since $k = x - 0{\cdot}6 = 7{\cdot}2$ inches); and $V_6 = v_3 - V_5$. $V_6 = 22{\cdot}6 - 7{\cdot}2 = 15{\cdot}4$; then $z = 15{\cdot}4 - (8{\cdot}5 + 3{\cdot}2) = 3{\cdot}7$ inches; showing an increase of 0·6 inch over the difference of level. This is as it should be, as the high tension of the gas in the cup drives the water lower in V_6, on account of the decrease in tension of the holder gas.

(4) As the holder continues to fall, and as that portion of the cup which is part of the upper section sinks into the pit water, the displacement of that water by the cup proper tends to produce a partial vacuum in the space occupied by the gas confined in the cup. This decrease of the tension of the gas causes the water to rise in the section W_9, and also in W_7; and this motion of the water will continue until the water from W_9 begins to overflow into the section W_7. This is the moment illustrated in fig 5. At the instant referred to, the difference of level of the water in W_7 and W_9 equals 3·2 inches, since W_8 is open to the atmosphere, and W_9 communicates with the water below the holder gas. It is also evident that O is equal, in inches of water, to the vacuum that would be shown on a gauge set on the

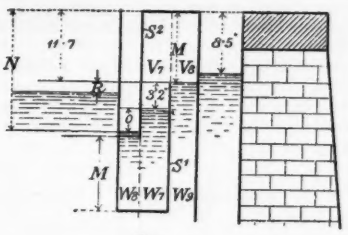

FIG. 5.

top of the holder cup. M denotes the vertical distance through which the upper section has moved since uncupping. Then p_4 is equal to the pressure of the cup gas = 408 − O. In the third case, the water under V_6 was 15·4 inches from the top of the holder cup; in the fourth case, W_9 has risen through 15·4 − M inches. It is also seen that the water under V_5 in the third case has in the fourth case risen through 7·2 + O inches. Now the cup in falling has displaced the water in the pit, and so created a volumetric displacement of (2·8 + 4) × M = 6·8 M. If this be divided by 4, to make the volume accord with the gas volumes, where the factor 4 was excluded, the displacement equals 1·7 M. The rising water in W_7 and W_9 moves to counteract, in part, this displacement. Hence we have $v_4 = V_7 + V_8 = v_3 + 1{\cdot}7$ M − (15·4 − M) − (7·2 + O) (2); also $p_4 = 408 - O$ (1); and $v_4 p_4 = v_3 p_3 = v p = 9368{\cdot}3$ (3). Reducing (2), we have $v_4 = 22{\cdot}6 + 1{\cdot}7$ M − 15·4 + M − 7·2 − O; but see fourth case. v_4 also = 2 M + 3·2 (4). Then 2 M + 3·2 = 2·7 M − O; whence $O - \frac{7}{10}$ M = − 3·2 (5), and $M = \frac{10}{7}(O + 3{\cdot}2)$ (6). Substituting in (4), we get $v_4 = \frac{20}{7}(O + 3{\cdot}2) + 3{\cdot}2$ (7); and substituting (7) and (1) in (3) (20 O + 64 + 22·4) (408 − O) = 7 × 9368·3. Whence $O^2 + 403{\cdot}68\ O = -1516$, and O = 3·8 inches. Then M = 10, $v_4 = 23{\cdot}2$, $V_7 = 13{\cdot}2$, $V_8 = M = 10$, $p_4 = 404{\cdot}2$, and R = 3·2 − (10 − 8·5) = 1·7 inches, and N = M + 3·2 + O = 17 inches; showing that, to an observer outside the holder, the water at W_8 apparently sinks or lowers to 17 inches below the top plate of the cup. If the plate S_1 leaks near the upper edge, or if a lateral displacement of the plate S_1 were to divide the space within the cup differently, so that W_8 and V_8 were in different ratio, the water in W_8 would lower by an amount different from that above determined. It will thus be seen that, while the upper section is descending through a vertical height of 10 inches, the water in the cup in W_8 is falling through 17 − 0·9 = 16·1 inches. If the holder were to remain stationary at a point just above the limiting 10-inch fall, pipes supplying steam to water in W_8 would require to be turned much lower than at any other time. The holder scarcely ever stands thus in practical working. As soon as the water begins to pass from W_9 into W_7, its rate of flow increases until the maximum is reached; and the strength of the current is sufficient to carry some of the water below the edge of the plate S_2, and thus to force it into the division W_8. If condensed oil or drip liquor lies upon the surface of the holder water, it will be the first to overflow into W_7; and if the depth of such liquor lying within the holder is sufficient, it is clear that all the liquid flowing from W_9 into W_7 could be this liquor. The flow described continues until the water at W_8 stands at the same level as the water between the holder wall and the masonry of the pit.

(5) Suppose that equilibrium is again established, and the holder is still falling. Let p_5 be the pressure of the gas within the cup; then $v_5 = 2$ (8·5 + G), and $p_5 = 408 + G$, $v_5 p_5 = v p = (17 + 2\ G)$ (408 + G) = 9368·3. $G^2 + 416{\cdot}5\ G = 1216$, G = 3 inches. $v_5 = 2 \times 11{\cdot}5 = 23$; $p_5 = 408 + 3 = 411$. At this time the pipes supplying steam to the cup water must be turned down 8·5 inches lower than is necessary when the holder is cupped, and the cup evenly filled with water on all sides. If then steam is turned on to the holder hose when the holders are cupped, as soon as they uncup the pipes must be turned down, or the steam, issuing into the atmosphere, will be useless and wasted; and when the holders cup, the pipes must be turned up again, or else they are dipped into the water too much to permit the most effective use of the steam.

Frequently holder cups do not stand level. This may be due to construction, to adjustment of the guide-wheels, or to effect of wind. Suppose, in the above holder, that the pipes were immersed 3 inches when the holder was uncupped, and that upon cupping the holder canted—throwing the water out of level 6 inches, and the steam-pipes remaining undisturbed. A break in the hose could start a syphon, which, if it occurred on the high side of the holder cup, could draw the water from the cup as low as 8·5 + 3 + 6 = 17·5 inches on the low side. Before this point would be reached, in the process of syphoning, the cup seal would have been broken; and the upper section would literally fall through the lower section, and all the gas contained in the lower section would be lost— escaping into the atmosphere. Such an accident could happen from other causes —as, when the holder is falling, if the lower section meets some obstruction in the pit, or the lowest guide-wheels stick, the continued withdrawal of gas will break the seal. When the great weight of the lower section is no longer balanced by the pressure of the contained gas, it generally suffices to break away or force through the obstruction; and both sections reach the pit water

in the condition of just at the cupping-point. In one instance an accident of this kind occurred when 300,000 cubic feet of gas were lost in three minutes. The cause was attributed to a piece of wooden staging adrift and afloat within the holder pit. The holder was not damaged in any way; and there were no possible means of definitely ascertaining the true cause of the break in the seal, as the cup was full of water, perfectly tight, and very nearly level.

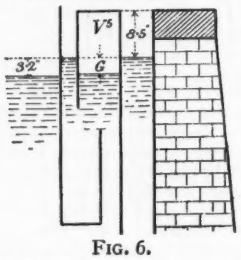

FIG. 6.

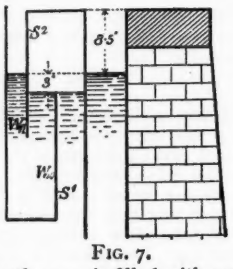

FIG. 7.

(6) When the holder rises again, the cup is filled with water, or with water and liquor of condensation in varying proportions. In fig. 7 the sheet S_1 is shown as on the point of rising clear of the pit water. As the cup continues to move upward, the gas confined within the cup forces the water W_{10} down on one side and up on the other side of the sheet S_2; finally causing the excess of water to overflow the cup into the pit. In the first case considered, the total quantity of water carried in the cup was 103·6. In this case, the greatest amount of water carried in the cup (see fig. 6) is $W_{10} + W_{11} = W_6 = 4 \times 18 + 2{\cdot}8\,(18 + 3) = 72 + 58{\cdot}8 = 130{\cdot}8$; and then $W_6 - W_1 = 130{\cdot}8 - 103{\cdot}6 = 27{\cdot}2 = Q_2$; showing that a quantity of water equal to 27·2 cubic inches for every inch of the circumference of the cup must overflow from the cup into the pit during the process of cupping. Denoting the total water thus overflowing from the cup by Q_2, we find that Q_2 in gallons equals nearly—

$$\frac{151 \times 12 \times \pi \times 27{\cdot}2}{231} = 670{\cdot}3$$

If to this amount Q_1 be added, it appears that (670·3 + 305·6) = 975·9 gallons of liquid overflow from the cup into the outer pit every time the holder cups and uncups. This furnishes the data for the depth of the superposed curb, in a holder cup fitted as shown in fig. 8. For each inch in depth that the water is forced from the section A, it rises in section B by (4 ÷ 2·8) 1·43 inches. Then, by considering the greatest gas pressure that occurs within the cup at any time of cupping or uncupping, the extreme height of the upper curb can be ascertained. If it is desired to prevent the overflow of any liquid from the cup, it will be necessary to add to the depth of the curb thus determined an allowance for the tilting of the holder, and the consequent unevenness of the plates of the cup. With the manufacture of enriched water gas, it will often happen that some of the enriching oils will be condensed when the gas has been imperfectly fixed. If large quantities of such a gas pass into and out of a holder, a great deal of oil will accumulate within the vessel—lying upon the surface of the water. Repeated cupping and uncupping of the holder may easily transfer considerable quantities of such liquor from within the holder to the belt of pit water outside, whence it can pass by the overflow. Here, therefore, is another danger developed, since the oil referred to is very inflammable, easily volatilized, and a great menace to any sewer or drain into which it may have run.

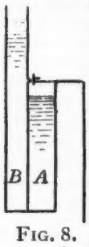

FIG. 8.

Suppose the holder above described is cupped, and tilted to the extreme limit in one direction, so that the water on (say) the north side is 6 inches low—the steam-pipes being in service, and adjusted so that they dip by only 2 inches. If now the holder is tilted in the opposite direction, by reason of a change in the current of a very high wind, a break in the steam-hose on the north side of the holder could start a syphon, which might lower the cup water 8 inches at that point. Then the water on the south side, being already 6 inches low before the break, would be lowered to 6 + 8 = 14 inches, and the seal would be broken. This fact makes necessary the readjustment of the steam-pipes after every extreme change of level of the cup water following a change of direction of the wind, &c. The introduction of horizontal swinging check-valves impedes the delivery of steam to the cup; but this objection can be set off by giving to the pipes such a capacity that there will be a surplus over the maximum requirements of the coldest weather. A primary object of the steam being to keep the water in circulation, the pipes should enter the water in such a direction that the impact of the steam may effect this object.

The general subject may be summarized by stating that frequent careful inspections would minimize the chances of an accident, the occurrence of which is easily possible.

Underground Conduits in New York City.—The underground conduits in New York City have now a length of 1667 miles. In these conduits there are about 32,600 miles of telephone and telegraph wires and 1300 miles of wires for lighting purposes, with [which about 6790 arc lights and 268,000 incandescent lamps are connected.

GAS-ENGINES FOR DRIVING TRAMCARS.

The application of gas for driving tramcars has recently attracted considerable attention on the Continent, and has provided material for two lengthy papers in the pages of the *Journal für Gasbeleuchtung*. From reprints of these, in pamphlet form, with which we have been favoured, we observe that much of the matter is common to both, and the substance of the two papers may conveniently be presented to our readers in one article. Herr A. Kemper, Chief Engineer of the Dessau Works of the German Continental Gas Company, communicated one paper to last year's meeting of the German Association of Gas and Water Engineers; and Baron Gostkowski, of Lemberg, is responsible for the other.

Both the authors enumerate the various methods which have been used or proposed for the driving of tramcars. Steam is dismissed as unsuitable for use on roads, on account of the excessive weight of the locomotive cars, and the heavy permanent way required, apart from the annoyance caused by smoke, steam, ashes, and sparks escaping. Compressed air is used for driving tramcars at Berne; but it is too expensive for general adoption. For the same reason, or for want of exact information, carbonic acid and ammonia motors, as well as Connelly's engine for the consumption of vaporized naphtha, are discarded. Herr Kemper alludes to the cable tramway; but he considers it only suited for use on very steep gradients, where a system dependent for traction on the adhesion weight of the cars would be quite inadmissible. The first cost of cable tramways is high; and the breakage of the rope brings traffic to a standstill. There remain then only three sources of power deserving consideration—viz., horses, electricity, and gas.

Objection may be taken to the use of horse power on sanitary grounds, as well as on account of the lack of precision in stopping, and the generally uncertain control over power possessed of volition. On the other hand, horse power readily adapts itself to the resistances to be overcome; and on rises and curves, a horse can exert ten times its normal power for a short time. The horse-power unit of 75-second metre-kilogrammes adopted in mechanics represents the force a horse can exert continuously; and it is evident that mechanical motors for tramcars must be of at least 8-horse power, in order to cope with considerable temporary obstacles. The cost of horse traction for tramways will be estimated later.

Electric tramways have found extensive use in America; and they are viewed favourably in Germany. It is evident that, in order to gain adoption, gas must be proved to be able to compete with electricity for driving cars. The methods of applying electricity for this purpose, and its cost in each case, must be briefly considered. The chief difficulty with electric cars lies in the conveyance of the energy to the motors attached to the car. There are three methods by which the energy may be supplied to the motors—viz., (1) from accumulators, (2) from underground cables, (3) from aërial conductors.

The ideal method is by means of accumulators, as each car carries its own source of power, and is independent of conductors; but trials in many places—notably in Brussels and Hamburg—have not resulted in its general adoption. The reason lies in the heavy weight (from two to four tons) of the accumulators, their unsuitability for yielding a varying current, the necessity for changing them every three to five hours, and the great loss of energy rendering the cost of working extremely high. The second method of supply—with an underground conductor—has also been but little adopted. Its first cost is high; and the narrow conduit open to the street is objectionable to other traffic, besides needing very perfect drainage if interruptions through access of water and various objects are to be avoided. In Budapesth, where this system is at work, few interruptions occur; but the expenses are very high. Thus the only generally available and cheap electrical tramway system is that with overhead conductors, which is in operation in many German towns. In expense of working, it compares favourably with horse tramways; but the initial outlay is greater. On æsthetic considerations, it must meet with disapproval, on account of the conductor being placed some 18 feet above the roadway, with its obstructive supports disfiguring the paths.

Each track, according to this system as in use at Halle, has two overhead conductors, joined at intervals of about 200 yards; so that a break in the working conductor may not cause the interruption of the current throughout the line. Beneath the body of the car are two electro-motors, each of 15 nominal horse power, and each driving one of the main axles. They work either together or singly. The motors make 1200 revolutions per minute; and by cog or chain gearing this number of revolutions is reduced in transmission to the driving axles. The resistance boxes and regulating apparatus are attached to the platforms. The cars weigh about 5 tons, or with the complement of 28 passengers about 6½ tons. For the rate of 10 feet per second on a level track, Herr Kemper calculates that the electro-motors must develop about 4-horse power, which, allowing for losses, means at least 6-horse power generated at the central station. The electro-motor cars are superior to others on up gradients. They are capable of maintaining their normal speed on a rise of 1 in 15. According to the statement of an electrician, the working expenses, including depreciation, of this system of electric tramways may be taken at

20 to 25 pf. per kilometre run (4d. to 5d. per mile). The working expenses of a single-horse tramcar are estimated at 22 to 28 pf. per kilometre. So the electric system is cheaper in working; but the greater capital outlay makes the return nearly the same.

Tramways with gas-driven cars may now be considered. The receptacles for carrying coal gas on the cars resemble the reservoirs used on railway carriages for compressed oil gas, and the compressed air-reservoirs used on the tramcars at Berne. The gas supply may be taken from the street mains; but one or more compressing and filling stations are required. These should cost, with all accessories, from £400 to £600. According to Herr Kemper's project, an 8-horse power gas-engine drives a compressing-machine, which is capable of compressing 2100 cubic feet of gas (at 8 atmospheres) per hour. The cylinder of the compressor has a diameter of nearly 6 inches, and a stroke of nearly 13 inches. A pipe 1¼ inches in diameter leads from the compressor to the storeage vessels, which have a united capacity of 400 cubic feet. At 8 atmospheres pressure, they can give to the car reservoirs 800 cubic feet at 6 atmospheres—sufficient to charge two cars. The charging of a car is accomplished in about a minute. The compressing-station is only 13 feet wide by 20 feet long. The gas-engine used to drive the compressor consumes about 8 per cent. of the quantity of gas compressed, or 1-horse power compresses about 350 feet.

Two systems of cars have been devised for propulsion by gas power. The firm of Guilliéron and Amrein, of Vevey, Switzerland, are the manufacturers of the cars used on the Neuchâtel to St. Blaise line. Neither of the authors is able to give much information on the working of these cars. They weigh 6 tons each, and carry 20 passengers; they are driven by an 8-horse power twin gas motor on one of the platforms, and consume, according to different estimates, from 24 to 33 cubic feet of gas per mile run. The line is a little over three miles in length; and the car reservoirs hold sufficient gas for the out and home journey. The cars cost £600 each; but the power provided seems scarcely sufficient to overcome the rises—up to 1 in 30—which occur on the line. The condensing arrangements are perhaps superior to those of the other system, which is that of Herr Lührig, of Dresden. Trial runs have been made on the Dresden tramways with cars constructed on Lührig's plan; and the cost of working is calculated therefrom by both authors. There are ten small gas reservoirs on each car—two on the roof, the remainder beneath the body of the vehicle—having a united capacity of from 45 to 65 cubic feet. As they are filled to six atmospheres pressure, they contain, when freshly charged, six times this volume of gas. The pressure is reduced by means of regulators, similar to the Pintsch governors, on the supply-pipe to the engines. These are two, each of 7 to 8 horse power, so placed under the seats that the fly-wheels are outside and below the seat backs, but do not protrude beyond the sides of the car. Both gas motors drive one shaft, which gears by cog-wheels on a second shaft, from which, by means of chains, the power is conveyed to the axles of the car. By the aid of controlling levers, the driving-shaft can be caused to turn at three different speeds. The slowest is for use when the motor runs free, as during short stoppages; the medium one, for ordinary running; and the fastest, for heavy work. The controlling levers on the driver's platform are as follows: A foot lever for controlling the gas motor; a hand lever for altering, by means of a clutch coupling, the rate from medium to fast or *vice versâ;* a hand lever for controlling the direction, backwards or forwards, of travelling; and a hand wheel, which, by means of a friction clutch, simultaneously applies the brakes, and allows the motor to run free. By means of these, any desired manœuvre can be carried out with greater ease and simplicity than might at first glance be supposed. Ignition is effected by means of a small electro-magnetic apparatus. The condensing water is carried in a tank on the top of the car, and circulates automatically; so that it seldom needs replenishing. Galvanized iron plates, with flaps opening to permit of inspection, shut off the motors and machinery from view. No noise from the machinery is perceptible in the car while travelling; but when stopping the machinery running free makes a slight noise, and a little vibration may at the same time be felt. The large car for level roads can carry at least 29 persons; but Herr Lührig has constructed smaller ones for use on heavy gradients.

The first cost and the working expenses of the Lührig tramcars are discussed at length by both authors; but as they take somewhat different data for the calculations, the results are not strictly comparable with one another, though each may be fairly compared with the cost of electric tramway traction arrived at by the same writer. Herr Kemper estimates the cost of construction of a tramway five miles in length, with all appurtenances, for gas, electric, and horse traction. The respective amounts are £30,000, £38,000, and £28,000; so that the first cost of a gas tramway is slightly higher than that of the horse line, but considerably lower than that of the electric tramway. This is largely due to the necessity for constructing a central station for the supply of electrical energy; whereas every town where tramways are adopted will have a gas-works. As the tramcar motors work almost entirely in the daytime, when the ordinary consumption of gas is at the minimum, the use of gas for driving them would tend greatly to equalize the consumption in a town, and so indirectly render the management of the works an easier task than it is at present. Then taking gas at 3s. 4d. per 1000 cubic feet, the cost of working, with allowances for depreciation of rolling-stock and machinery, is arrived at for a year; and from this the cost per car per mile run is calculated. It amounts to almost exactly 3d. If gas is taken at 4s. per 1000 cubic feet, the cost per mile per car would be about ¼d. higher. Herr Kemper computes that the working expenses of a 1-horse tramcar are 4s. 2d. to 5s. 4d. per mile; those of an electric car, 3s. 8d. Taking the average number of passengers in the tramcars in Germany in 1889, he reckons out at low fares the receipts of such a line as the one projected above. He finds that, whereas the electric line would yield no return to shareholders, the gas-motor line would certainly pay 6½ per cent. on its capital.

Baron Gostkowski, who studied the working and cost of gas-driven tramcars with a view to recommending their adoption in the town of Lemberg, takes the heating power of Lemberg gas for the basis of his calculations, and arrives at nearly the same result as the Dresden gas actually gave in working. He then calculates, with considerable detail, the gas consumption and working expenses for the projected line of 5¼ miles in Lemberg. As the gas-works will be under the municipal authorities at the time when the tramway could begin work, he takes gas at the cost price of 1s. 10d. per 1000 cubic feet, and finds that traction would then cost about half of the average cost of horse traction on the tramways of a number of Continental towns. Finally, he computes the cost of traction of a car by electricity on the aërial conductor system; and, allowing for interest on capital, he shows the gas-motor car to be 24 per cent. cheaper in working than the electro-motor car. He further states that Connelly's system of driving cars by gas generated on the cars themselves from naphtha, which has been adopted in Chicago and other American towns, can be worked there at one-third the cost of horse tramways, and one-half that of the electric line. Though it is being tried on one of the lines in London, this oil-gas motor is more likely to be adopted in oil-producing countries than elsewhere.

Fires Caused by Accidents to Oil-Lamps.—At the meeting of the Manchester Section of the Society of Chemical Industry on the 1st ult., a discussion took place on the flashing-point of mineral oils. It was opened by Mr. J. Carter Bell on some notes forwarded to him by Mr. D. R. Steuart. Mr. Bell stated, in the course of his remarks, that he had received some figures with regard to fires in London in the years 1890-92, from which it appeared that, in 1890, out of 2555 fires, 271 were due to lamp explosions; and of these, 51 were the result of accidents to the lamps. The total number of deaths was 61, of which 15 were due to such accidents. In 1891 there were 290 fires due to lamp explosions, 46 explosions caused by accidents to lamps, and 12 deaths attending these accidents. In 1892 the figures were: 275 fires, 82 from explosions, and 16 deaths. In a communication to *Fire and Water*, Mr. Steuart gave a table of the total fires since March, 1892. Of 1791 English fires, 156, or 8·71 per cent., were caused by lamps; of 1765 Scotch fires, 35, or 1·98 per cent.; of 261 Dublin fires, 18, or 6·89 per cent. Of 10,840 fires in New York and Chicago, 1002, or 9·24 per cent., resulted from lamps. The percentage in Toronto was 8·10; in Paris, 23·91, but inclusive of more than lamp accidents. In Berlin, out of 2574 fires, 650, or 25·25 per cent., were caused by lamps. These are really serious figures. The result of the discussion was the passing of a resolution to the effect that the present legal flashing-point of mineral oil ought to be increased to a standard of not less than 100° Fahr.

Professor Lewes's University Extension Lectures on the Technology of Coal Gas.—In the JOURNAL for the 19th ult., we called attention to the course of seven lectures on "The Technology of Coal Gas," to be delivered by Professor Vivian B. Lewes, F.I.C., F.C.S., in connection with the Technical Classes formed by the Corporation of West Ham. They constitute the principal portion of a course of ten, on "The Chemistry of Arts and Manufactures," which Professor Lewes has prepared for delivery under the University Extension Scheme. The first of the seven lectures to which we are now specially referring is to be given this evening in the Stratford Town Hall; and the following outline of it and the succeeding lecture is taken from the syllabus which has been prepared. The lecturer will first deal with the origin and composition of coal, and explain the actions which take place when this mineral is exposed to the atmosphere. He will then show how oxygen, condensed from the air, is taken into the pores of the coal, with the result that the most easily oxidized constituents of the mineral—viz., the compounds of carbon and hydrogen, which are the most valuable for gas-making purposes—are attacked. The lecture will close with some remarks on coal storeage, and the causes which lead to spontaneous ignition. Next Tuesday's discourse will be on the composition of coal gas. This subject will be considered under the headings of (1) the combustible diluents, (2) the illuminants, and (3) the impurities in coal gas. The preparation and properties of its chief constituents, and their influence upon its illuminating power, will next be discussed; and the lecturer will conclude by showing the effect of these constituents upon the size of the flame when the gas is burned at a definite rate of flow. The remaining lectures will be noticed in subsequent issues.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Peebles Oil-Gas Process and the Huddersfield Oxy-Oil Plant.

SIR,—Mr. Herring, in blaming me, in his letter in the last number of the JOURNAL, for not visiting Huddersfield and seeing his oxy-oil gas plant in operation a month after the date of his invitation, or in the end of April last, has overlooked the fact that Dr. Thorne, in his paper, states that the plant at Huddersfield was only started well on in August, and that consequently Mr. Herring was not in a position to show me in April what he blames me for not going to see.

I have also to refer Mr. Herring to Dr. Thorne's paper for the definition of a "fairly large stream of oil" used in connection with the cracking-up of oil into gas. The Doctor defines it as such a stream of oil as will produce a considerable proportion of residuals. Will Mr. Herring refer us to any known oil-gas process, prior to the Peebles process, where the oils were cracked-up by repeatedly running them into the retort in a fairly large stream, so as to produce, each time they are run through the retort, a considerable proportion of residuals?

I am pleased to learn that Mr. Herring's interest in the success of the oxy-oil gas process is only so far as the Huddersfield Corporation is concerned, and that his experience of the Huddersfield Corporation is such as to warrant him in saying that they will deal justly in recognizing the novelties of the Peebles process.

WM. YOUNG.

Priorsfield, Peebles, Jan. 17, 1894.

Extension of the Rhyl Water-Works.—The Rhyl Improvement Commissioners have resolved to borrow £8750 for the purpose of carrying out improvements in the water-works, as recommended by their Consulting Engineer (Mr. G. F. Deacon).

Water-Works for Lostwithiel.—The Lostwithiel Corporation having applied to the Local Government Board for sanction to borrow £2500 for constructing water-works for the town, an inquiry was held into the matter by Mr. R. Codrington, M.Inst.C.E., last Tuesday. The scheme which has been adopted was projected by Mr. S. Jenkins, of Liskeard; and the water is to be obtained from springs on land belonging to Lord Robartes.

Public Lighting of Mexico.—According to a recent report of the British Consul at Mexico, the public lighting of that city is carried out by 326 electric arc lights of 2000-candle power, 151 arc lights of 1200-candle power, 1624 oil and naphtha lamps, and 208 gas-lamps. The cost of each class of lighting per hour is as follows: 2000-candle power electric lights, 3·2d.; 1200-candle do., 2·8d.; oil and naphtha lamps, 0·49d.; gas lamps, 0·46d.

The Kettering Local Board and the Water-Works.—The Kettering Local Board last Thursday adopted a resolution, appointing a Committee to consider the advisability of purchasing the local water-works. It was stated that, in round figures, a sum of £68,000 was invested in the undertaking, and that the balance-sheets for the half years ending December, 1892, and June, 1893, showed that a dividend of 4¾ per cent. was declared upon the "A" capital, and 3½ per cent. on the old and new "B" capital.

Para Gas Company, Limited.—The report and accounts of this Company for the past year disclose an improvement in the position of affairs. The revenue account for the first half of the year shows a profit of £778; and that for the second half, a profit of £1562. The balance on the profit and loss account amounts to £6755. From this the Directors recommend a dividend at the rate of 7 per cent. per annum on the £5 called up on the preference shares, and 2 per cent. on the ordinary shares. In their report, the Directors are glad to be able to mention that, notwithstanding the disturbed state of Brazil, the monthly payments for the public lamps have been made with increased punctuality, which has enabled the Company to improve the service. Tenders have been invited for the lighting of the city, and the Board have submitted a proposal to the Government, which, if accepted, they will refer in due course to the shareholders for approval.

The Public Lighting of Liverpool and the Increase in the Price of Gas.—At a special meeting of the Liverpool City Council last Wednesday, the Watch Committee's estimates were under consideration. The items of expenditure on account of lighting for the year included £40,036 for public lighting (11,132 lamps); new lamps and alterations and repairs brought the amount up to £42,216; to which were added £1350 for salaries and wages, £600 for rent and establishment charges, and £300 in connection with the electric department. Mr. Hornby, in moving the adoption of the estimates, pointed out that they showed a reduction of £1500 as compared with the original estimate, which was based on the increased price of gas, and on the assumption that the hours of lighting would be the same as previously. Of course, the £1500 meant a reduction of lighting. Alderman A. B. Forwood said if there was one point more than another which was important in Liverpool, it was that the city should be well lighted. Undoubtedly they were deficient in this respect in many of the back streets; and he should rather have expected to see the expenditure on lighting increased than diminished. It was a question for the lawyers to decide whether the Gas Company had a right to advance the price. But everybody knew that the Company had a right to a certain maximum dividend; and whether they got it out of the consumers of gas or the ratepayers in the matter of street lighting made very little difference. He strongly protested against any reduction which would restrict the lighting of the city. Mr. Williamson thought the people of Liverpool need be under no apprehension whatever with regard to the lighting. The Committee had for some time had under consideration various methods whereby they might reduce their expenses without appreciably diminishing the light given to the inhabitants. If the legal question between the Gas Company and the Corporation was decided in favour of the latter, the Committee would have £3000 to the good. It was also believed they might economize by lighting the lamps themselves, instead of having the work done by the Company's servants. After further discussion, the estimates were adopted.

PARLIAMENTARY INTELLIGENCE.

EXAMINER'S ROOM, HOUSE OF COMMONS.—Thursday, Jan. 18.

(Before Mr. CAMPION.)

LONDON COUNTY COUNCIL (WATER) BILL.

In the JOURNAL last week, we announced that a memorial, complaining of non-compliance with Standing Orders in the case of the above-named Bill, had been presented on behalf of certain London Water Companies. To-day Mr. Campion, one of the Examiners, inquired into the allegations contained in the memorial, which were to the effect that the notices published in the *London Gazette* and the local newspapers were not sufficient to describe the objects of the Bill.

Mr. REES (of Messrs. Rees and Frere, Parliamentary Agents) represented the memorialists; Mr. C. A. CRIPPS (of Messrs. Dyson and Co.), Parliamentary Agent to the London County Council, appeared for the promoters of the Bill.

Mr. REES said that the memorial bore the signatures of officials of different Metropolitan Water Companies who had a very large interest, both indirectly and directly, in the subject-matter of the Bill. He explained that Clause 4 of the Bill provided that "Section 4 of the London Water Act, 1892, shall extend and apply to the purposes of this Act;" and that the notices did not state the intention of the promoters to include in the Bill such a provision.

Mr. CRIPPS said he had two objections to take to the memorial, either of which, if upheld, would be fatal to it. The procedure in that room was of a very technical character; and as the whole of the opposition was of that character, the promoters were entitled to a strict compliance with the technical rules. The memorial in the first place complained of insufficient notice in the *Gazette* and the "local newspapers;" but he contended that no publication of notice of the Bill was required in the local newspapers—that published in the *Gazette* being sufficient.

The EXAMINER said he could not go into that question, which was not raised by the memorial; and as the allegation was in the ordinary form, Mr. Cripps's objection must be disallowed.

Mr. CRIPPS then urged another objection—viz., that, the opposition being that of the Water Companies and not of the individual signatories, it had not been properly framed, and that, upon the strength of previous decisions, the memorial could not be entertained.

The EXAMINER: Where does it appear that it is the memorial of the Water Companies, except in the signatures?

Mr. CRIPPS said it did not appear anywhere, except in the signatures. The first signature was that of James Searle, Clerk to the New River Company. The other signatures were: F. H. Wybroo, Secretary of the West Middlesex Water Company; J. Goodwin, Secretary of the Grand Junction Water-Works Company; H. W. W. Harrison, Assistant Secretary of the Chelsea Water-Works Company; and I. A. Crookenden, Secretary of the East London Water-Works Company.

After some discussion, and the citing of cases *pro* and *con.* bearing on the point,

The EXAMINER said the memorial must be considered as that of individuals, and not of the Companies. All he would have to do would be to strike out the descriptions after the names, and allow the memorialists to appear as individuals.

Mr. REES said they had memorialized and taken other proceedings in Parliament for many years in the same form, without objection. Proceeding to deal with the substance of the memorial, he said the recitals of the Bill were of a very important character. The first material one was: "Whereas some of the areas in Great Britain best adapted for sources of water supply have been already appropriated, under the authority of Parliament, by the municipal authorities of the principal cities and towns; and powers for the appropriation of further areas have been from time to time granted, and are from time to time applied for on behalf of other populous and increasing places." He supposed they might assume that this referred to the gigantic water schemes, already sanctioned, which had been promoted by the municipal authorities of Manchester, Liverpool, and Birmingham; and he therefore asked the Examiner to consider what was the magnitude of these schemes, and the magnitude of the powers which were sought by this Bill. Those schemes involved in each case the outlay of millions of money. The Bill pointed to, or was evidently based upon, the idea that it would be convenient for the London County Council to take, by way of purchase, lands as the preliminary first step in the promotion of such schemes as those; and when it was borne in mind that London was six or seven times as large as the three cities named put together, they would get some idea of the magnitude of the financial proposition involved in the Bill. The next recital was: "And whereas it appears that the means for the supply of water to London and the neighbourhood are inadequate, and that larger quantities of water than can now be legally obtained are required for that supply; and that, if the Rivers Thames and Lea are to be relied upon for the future water supply of London, considerable additions are necessary to the arrangements for storeage, filtration, and purification." There they were pointing out that the proper mode of providing for the increase of the water supply might be by means of a large storeage reservoir up the valley of the Thames; and this, of course, would involve also the acquisition of very large areas of land and the expenditure of an enormous sum of money. The next recital was: "And whereas it is estimated, in view of the probable increase in the population of London and the neighbourhood, that the existing sources of supply might, at no distant period, become inadequate, while the increasing population in the valleys of those rivers will render it increasingly difficult to maintain their water sufficiently pure and wholesome for drinking purposes." There the promoters went beyond the report of the Royal Commission on Water Supply, and harked back upon their "first love"—the idea which they knew a great many people connected with the London County Council had in their minds—the expediency of going to Lake Bala, or something of that sort, for a supply of water. The enactment on those recitals was contained in clauses 2 and 3 of the Bill, which provided:

"It shall be lawful for the Council to purchase by agreement or take on lease (1) any lands, houses, and buildings or easements, and (2) any water-works, wells, waters, or rights to take or convey water, which the Council may think it desirable to purchase or take on lease with a view to the future supply of water to London and the neighbourhood. It shall be lawful for the Council to hold and manage any such lands, and from time to time let such lands, works, or rights, or any of them, on lease or otherwise, and to sell or exchange any of such lands." Power was thus given to purchase lands for the gigantic objects described in the very widest possible terms. No specific area was pointed at; but absolute unlimited discretion was to be given to the Council to buy any quantity of lands, anywhere, at any cost, at the expense of the ratepayers of the County of London. Where was the money to come from for this enormous outlay? They would be astonished to find that the only mode in which the money was to be provided was in these terms: "Section 4 of the London Water Act, 1892, shall extend and apply to the purposes of this Act." Section 4 of the Act of 1892 provided that the costs should be defrayed as payments for general county purposes within the meaning of the Local Government Act, 1888, which would have the effect of throwing upon the ratepayers of one year the whole cost of any such scheme. The County Council would be absolutely precluded from borrowing the money, and spreading it over a series of years, so that the future generations who would benefit should share in the expense; and he maintained that the ratepayers of the Metropolis should have been informed, by the notice, out of what funds, or in what other way, the costs and expenses of carrying out such powers were to be met. All that the notice said on this point was: "To amend and extend any of the provisions of the London Water Act, 1892." But the proposals in the Bill were, he contended, neither an amendment nor an extension of that Act. Such a purpose as that of charging upon the county fund such an expenditure as was contemplated—practically unlimited expenditure—was not sufficiently covered by such words as were used in the notice. The matter became rather more serious when it was considered what the position of the London County Council was, and that it was in no sense a Water Authority within the County of London. When promoters had a very specially important object in their Bill, they must not wrap up and conceal their object by the use of general words, but must express and give specific notice of it; and he contended that sufficient notice was not given by merely saying they were going to incorporate the provisions of another Act of Parliament. This had been ruled over and over again; and in support of this contention, he cited cases decided by the Examiners.

Mr. CRIPPS said he was perfectly satisfied that he could convince the Examiner that the notice in this case was as clear and specific as was necessary, and that it fully complied with the provisions of the Standing Orders. It had been held that no specific notice of any intention on the part of a local authority to resort to the ordinary means to meet its expenditure was at all required; and he cited the decision in the case of the British Electric Light Company's Bill, where it was stated to be the intention of the Company to enter into agreements with local authorities, but which was entirely silent upon the question of the application of funds. That Bill was opposed by a Gas Company on the ground that it would enable the local authorities, as it clearly would have had the effect of doing, to enter into agreements for the establishment of electric lighting works; and there was no specific notice of any intention to authorize those authorities to apply their funds for this purpose. Mr. Robinson, a former Examiner, held in that case that, if the local authorities were to exercise their powers, they must have the money given them to do so; and no person possessed of common sense would, on reading the notice, infer that the authorities were going to do it at their own expense. If he had any doubt about it, he would refer to the Bill to ascertain the precise powers by which they purposed doing so. Assuming the facts to be as Mr. Rees had stated them—though he differed from him a little with regard to them—there was no necessity for him to give any notice at all of the intention to apply funds or of the means by which funds should be provided. In the next place, he did not think any such legislation as that contained in clause 4 of the Bill was at all necessary; and that the whole clause was a work of supererogation. But, as the clause was in the Bill, he would not dwell upon this point. Beyond that, he submitted that the notice he had given was sufficient for the purpose. Mr. Rees had based some arguments on the suggestion that the Bill proposed certain gigantic schemes of water supply; and he had also referred to the large powers which had been granted to Liverpool, Birmingham, and Manchester.

Mr. REES: It is you who refer to them in your preamble.

Mr. CRIPPS said he thought Mr. Rees had really missed, to some extent, the scope of the Bill, or rather had looked at it with those jealous eyes which had led him to see beneath the surface something of a very formidable character which really did not exist at all. The Bill was an extremely simple one. There was no power or scheme to make any water-works, or any works whatever.

Mr. REES: There is power to buy water-works and to manage them.

Mr. CRIPPS said that what was intended was this: No doubt the London County Council suffered by not possessing some of the powers of municipal corporations. The Londoners of the future might possibly suffer because they had nobody to protect them in regard to the areas adapted for the supply of London, in the event of existing supplies becoming insufficient—an event which everybody admitted must occur. It was thought that, if this Bill were passed, some interests might be purchased, or some opportunities might offer of acquiring lands by agreement upon some river or some source of water which might hereafter be useful for the supply of London.

The EXAMINER: Would they not have power, under clause 2, subsection 2, to buy—of course, by agreement—all the rights of all the Water Companies of London?

Mr. REES: They may buy five out of six.

Mr. CRIPPS said there was nothing in that section which would or could give any power of supply at all. They could not buy from the London Water Companies, because the Companies had no power to sell. That section only applied to the case of water-works which somebody had power to sell; it gave no power of sale to any statutory companies at all. So far as the supply of water went, the Bill might go so far as to enable the London County Council to purchase water rights somewhere in the country. He did not know whether they could provide a water-barrel and a horse, to bring the water up; but, at all events, this was the extent to which the Bill could go. It was perfectly obvious that a scheme of water-works involved works, reservoirs, powers of making aqueducts, and all sorts of things which were not in the least degree contemplated or within the four corners of the Bill. If at any time, after having purchased lands or rights or water-works, the London County Council were to introduce a Bill to enable them to supply water, this, of course, would be a different matter; and then the question could be discussed. But the Bill was really of a much more limited character than Mr. Rees had suggested.

Mr. REES, in reply, said Mr. Cripps had entirely missed the point of his argument, which was that in this case the County Council were not following the ordinary course. The expenditure under the Bill being capital expenditure for which they ought to borrow money, they were prevented themselves from borrowing money by saying that the expenditure was to be paid out of the county fund. It would be the most iniquitous thing in the world that such an expenditure, amounting to hundreds of thousands of pounds, should be thrown upon the ratepayers of one single year.

The EXAMINER, in giving his decision, said: The question of object with respect to the finance of the scheme is to be regarded to a great extent as a question of degree. In the present case, I observe that, since the publication of the notice, the scope of the proposed Bill has been somewhat restricted; but the Bill still contains powers which certainly might be exercised on a large scale. Whatever might have been the intentions of the promoters (as to which I say nothing), I find it rather difficult to believe that any powers to be exercised with regard to so vast a community as that of London would be exercised on a small scale. Therefore it seems to me, having regard to the large proportions which this scheme may assume, the method by which it is proposed to apply the funds to these possibilities and to meet these requirements becomes an important object of the Bill, and that specific notice ought to be given of that method. But I do not think anyone reading the notice and the Act of 1892 together would imagine that the powers of that section (which is never referred to in the notice) were to be made applicable to purposes which appear to me so far in excess of anything contemplated by the Act of 1892. I must report the allegation.

The result of this decision is that no further progress can be made with the Bill until the question has been considered by the Standing Orders Committee, who will decide whether or not, and (if at all) on what conditions, the Standing Orders may be dispensed with.

Extension of the Leamington Water-Works.—The Leamington Town Council have accepted a tender amounting to £1492 for the construction of a new reservoir at Lillington; and they have also entered into an agreement for the purchase of the necessary land.

The Newcastle-under-Lyme Corporation and Payments from Gas-Works Loans.—The Town Clerk of Newcastle-under-Lyme has received from the Local Government Board a letter in which they state that they see no reason to alter the views expressed in their previous letter on this subject, and that they will expect to be shortly informed that the necessary steps have been taken for the recoupment of the loan accounts. This means that the extra £100 a year for three years allowed to Mr. W. Winstanley for special services will have to come out of the current rates, and not out of the loan sanctioned for the new works.

The Pretended Meter Inspector.—At the North London Police Court last Friday, Walter Coley, described as a clerk, was charged on remand (see *ante*, p. 112) on a warrant with obtaining money by false pretences, by the representation that he was an inspector employed by The Gaslight and Coke Company. He was further charged with having been concerned with another man, not in custody, in stealing a number of articles from a house at which he called. Mr. R. H. Humphreys prosecuted, and mentioned that the inquiries made since the prisoner's arrest showed that there were no fewer than 21 instances in which he had obtained admission to houses in the Highbury district on the representation that he was employed by the Company. In 12 cases property had been missed. The prisoner had given information to the police which had led to the recovery of a portion of the property; but most of it had apparently been pledged by the other man. The prisoner had been in the service of the Company for about a twelvemonth as an odd man. His duty was to attend on a fitter; and he consequently acquired a knowledge of the Company's practice. He was discharged on Dec. 16 last. After evidence had been given in several cases, the prisoner was again remanded.

St. Helens Gas and Water Works.—In the year-book issued by the Town Clerk of St. Helens (Mr. W. J. Jeeves), there are some interesting particulars with reference to the Gas and Water Departments. One of the important events of the past year was the opening of the water-softening works, on April 6, at a cost of £10,000; and this was followed in August by a considerable extension of the borough boundary, which now comprises 7248 acres, and a population estimated at 76,800. The outstanding corporate debt is £435,826—£171,745 is on the gas account, and £122,672 on the water account. The gas undertaking has also been extended during the year. The quantity of gas manufactured during the year was 225,131,200 cubic feet. The Corporation have now plant capable of manufacturing 1,250,000 cubic feet of gas per day, also plant for the manufacture of sulphate of ammonia and for the distillation of tar. They have storeage accommodation at Warrington Old Road for 750,000 cubic feet of gas, and at Knowleys Road for 1,000,000 cubic feet. The price of gas is 2s. 8d. per 1000 cubic feet in the borough, and 3s. 2d. outside. The latest returns of the consumption of water are for 1892—showing in that year a total supply of 1,010,496,587 gallons; being 540,445,987 gallons for domestic, and 470,050,600 gallons for trade purposes. At Brown Edge reservoir, there is storeage for 2,000,000 gallons; at Eccleston Hill, 500,000 gallons; and at Eccleston catchment reservoir, 6,700,000 gallons.

LEGAL INTELLIGENCE.

ISLE OF WIGHT PETTY SESSIONS.—Saturday, Jan. 6.

(*Before General the Hon.* SOMERSET J. G. CALTHORPE, *Chairman, and a Bench of Magistrates.*)

The Assessment of the Ventnor Gas and Water Works.

As briefly recorded in the JOURNAL last week, three appeals by the Ventnor Gas and Water Company against the re-assessment of their property in the parishes of Bonchurch and Ventnor, came before the Isle of Wight Magistrates on the above-named day.

Mr. E. BOYLE appeared for the appellants; Mr. BALFOUR BROWNE, Q.C., and Mr. G. G. GREENWOOD represented the respondents, the Assessment Committee of the Isle of Wight Union.

At the outset of the proceedings, a question was asked by the Clerk as to taking the three cases together.

Mr. BOYLE said there was an objection in the Bonchurch case, which put it on a different ground to the others.

Mr. BALFOUR BROWNE argued at considerable length that his learned friend could not then make a technical objection; and he quoted section 96 of the Parochial Assessment Act, which, he contended, showed that the Magistrates had no jurisdiction that day. An appeal should be made to the Quarter Sessions. The only question before the Bench was whether or not the Assessment Committee had rated these properties above their value.

Mr. BOYLE produced the valuation list, dated September, 1893, which showed that the Company were rated on £156 gross and £130 rateable; while, according to the rate-book, the figures were £320 and £224 respectively. He therefore submitted that the rating was incorrect; and he contended that the Bench had power to amend.

Mr. BALFOUR BROWNE explained that the Overseers rated the hereditament in Bonchurch at £324 or thereabout. The Assessment Committee held a meeting to hear objections on the part of the Company, who objected that the meeting was informal. In the meantime, the Committee took the advice of an experienced surveyor, who put the valuation, not at £300 odd, but at £156. In view of the objection of the Company that the meeting was informal, the Committee decided not to make an order for the £156, but to adjourn the matter so as to clear up the difficulty of informality, and that in the meantime the rate should stand as it was.

The CHAIRMAN said the figures he had before him were £320 erased and £156 put in.

Mr. BALFOUR BROWNE said the £320 was erased because the Overseers put it in; and when they looked into the matter, they found that £156 was the right figure. But when they were going to authorize the £156 to be inserted, objection was taken, and they could not do it, so the figures stood as they were. The objection of his learned friend would be more pertinent when the Company were called upon to pay the rates.

After considerable legal argument on the point raised,

The CHAIRMAN said the Bench must overrule the objection; and the case must proceed, and be heard upon its merits.

Mr. BOYLE said he could take the Bonchurch case no farther. He agreed with the valuation of the Assessment Committee, which was £156 and £130; but they had made a rate on £320 and £224. He asked the Bench to alter the rate in accordance with the Committee's own valuation.

Mr. BALFOUR BROWNE: I have no objection to that.

Mr. BOYLE: Then the order will be: "Appeal allowed."

Mr. BALFOUR BROWNE dissented.

Mr. BOYLE said he could not understand his learned friend objecting to that. He submitted that this was the course it must take.

After some further remarks,

The CHAIRMAN said the Bench were of opinion that, as both sides agreed to the figures £156 and £130, the alteration should be made; and they thought the parties should pay their own costs.

Mr. BOYLE then proceeded with the Ventnor appeals, which were, he said, against the rating. The old assessment on the Company's works in this district was £1157 gross and £876 rateable. These figures had been increased to £2400 gross and £1918 rateable. Then there was the house or office, which was the subject of the second appeal.

Mr. BALFOUR BROWNE said Mr. Ineson, the appellant in the second case, had never been before the Assessment Committee in regard to such property; and therefore the case could not be heard that day.

Mr. BOYLE remarked that the Company were the ratepayers.

Mr. BALFOUR BROWNE eventually said that, as it was a small matter, he was willing that the two cases should be taken together, rather than have any difficulty.

Mr. BOYLE proceeded to state that the old rating in the second appeal was £30 gross and £24 rateable, and that this had been increased to £40 and £32 respectively. The assessment on the two valuations had therefore been increased from £1187 gross and £900 rateable to £2566 gross and £2055 rateable; the last-named amounts including the new assessment on a reservoir of £126 gross and £105 rateable. It was an increase of £1155, or upwards of 120 per cent. In 1891 the Assessment Committee commenced making a new valuation list, to which the Company objected; and they called in a valuer to assist them in arriving at the correct amount. After many interviews and adjourned meetings of the Assessment Committee, the Committee agreed on Feb. 21, 1892, to the Company's objections, and altered the list in accordance therewith. Immediately afterwards, the Committee made a new supplemental valuation list, putting back the very figures which they altered on the Company's objection; and it was this against which they appealed. The chief point in the appeal was not the gross value. They did not object to that. What they did object to was the rateable value. Their reason for doing so was that there had not been sufficient deduction from the gross to arrive at the rateable value; only £511 having been taken off, whereas he should call witnesses who, from an examination of the Company's books, would state that the expense of maintaining the property in a state of repair to command the rent in accordance with the terms of the section was something like £1300 a year. Nothing was allowed for a reserve fund for replacing the premises which were in a very prominent position—in a very dangerous position, he thought he might say—from the action of the sea and the great exposure. The Company agreed to the gross value, excepting that of the house, and this was a small matter.

The following evidence was then given:—

Mr. *G. Humphreys-Davies*, Fellow of the Surveyors' Institution, said he had made a valuation of the Company's property at Ventnor. The works were altogether different, with regard to their peculiar situation, from any other works he had ever heard of; and he at once saw that a very heavy—he might say an entirely abnormal—outlay would be necessary to maintain them in a state to command the rent. The exposed position rendered expensive protection works necessary. The chemical and direct action of the sea water upon the works was injurious; and it was a very dangerous foundation upon which they were built, as it had a tendency to slip into the sea. With regard to the last-named point, he found that on one occasion the sea had carried away a retort-house and about 150 tons of coal. He could not understand how it was that the works were put there at all. On looking into the Company's accounts, he found that, during the past ten years, £11,920 had actually been spent in labour and materials for repairs of works and mains alone. About fifteen years ago, a new gasholder was built, and five years afterwards it had to be reconstructed owing to the subsidence of the foundation; while at the present time it required rebuilding. This, he estimated, would cost £1300; and it brought up the total to £13,220—thus giving an average expenditure of £1320 a year for repairs and maintenance. The Company were only insured against accident to the extent of about £4000. Any prudent landlord would provide against the risk from subsidence by a sinking fund (there was only a reserve fund of £250 at present); and he had also to consider the renewal, eventually, of the works. Even if repairs were continued, he had estimated that the life of the works would end in 25 years; and a prudent landlord should provide for their replacement in that time. On the sea side of the gasholders there were "pock-marks" from the action of the spray; but on the land side there were none. The Company had to make and maintain a very expensive sea wall; and this accounted in a very large measure for the heavy charge of £1320. Damage was still going on there. He put the depreciated value of the works for 25 years at £15,000; and for their replacement an annual charge of £411 would be required. This, together with the £1320, would make £1731; and after deducting from that amount £44 allowed in respect of property in other parishes, it left a net rateable value of £839. In his opinion, this was a fair sum, having regard to the position of the works.

In cross-examination by Mr. BALFOUR BROWNE, witness said he took for the gross value of the property Mr. Mason's figure of £2556. He knew that what might be deducted to arrive at the rateable value was the average annual cost for repairs and maintenance that had been properly expended; and, supposing there had been extravagance on the part of the Company, it should not be included in making the deductions. He was aware that a new gasholder was put in about fifteen years ago, and had to be replaced in five years. This was not due to defective construction, but to the subsidence of the foundations. His calculation of £1320 as the average annual expenditure for ten years included £1300 for a new gasholder. He did not know that, taking the period from 1875 to 1893, the average expenditure had been only £1000 for maintenance and renewals; but he could swear to the figures for the last ten years. His estimate of the present rateable value was £839. He knew that the old figure was £900; but this was fixed much too high. The Company might have distributed an average of £2660 a year in dividends from 1875 to 1893; but thishad nothing to do with the question. He estimated the life of the works at 25 years; and in addition to the average of £1192 a year that had been expended in repairs and maintenance, any prudent man would provide a sinking fund. He put the depreciated value of the works at £15,000; and if he heard that in one valuation it had been put at little more than half this sum, he should say that valuation was altogether wrong.

In re-examination by Mr. BOYLE, witness said his opinion was that, instead of extravagance, there had been rather an imprudent parsimony shown by the Company with regard to repairs and maintenance. The dividend paid by the Company had only averaged about 5 per cent. for the whole time that the Company had to pay rates on £900; and £250 was the entire amount in reserve.

Mr. *J. G. Livesay*, an architect and civil engineer of Ventnor, said he remembered the works being built, and had the management of them for more than twenty years. The stratum on which they were erected was the lower greensand. On this was the gault, or "blue slipper;" and above this the upper greensand. All the strata dipped towards the sea. He thought allowance should be made for rebuilding the works in 25 years.

In cross-examination, witness said the works had been rated at £900 for nine years; and this was the subject of an appeal in 1884. The dividend in that year was £870, while in 1892 it was £2867; but, of course, the works had been extended.

Mr. BALFOUR BROWNE: I find there has been a gradual increase going on in the dividend. In 1888 it was £2612; and in 1889, £2612. In 1890 there was a slight backward tendency—£2263. But in 1891 it was £2452; and in 1892, £2867. If the works have to be rebuilt in 25 years, you have practically been dividing money you had no right to divide?

Witness said it was not quite correct to put it like that. The Company had paid a very low dividend. It would have been more prudent to have provided a sinking fund out of their profits.

In re-examination, witness said there were copious springs rising in the upper greensand above the gault, which made it as slippery as moistened soap; so that with the dip to the sea, it would slip away in time. He should like to explain that the present site was the only one available at the time his father built the works.

Mr. *J. S. Ineson*, Secretary and Manager of the Company, gave evidence corroborative of that given by Mr. Livesay. He explained that the reserve fund was not available for renewals, but was to equalize dividends.

Mr. *C. W. Hastings* expressed agreement with the evidence of the previous witnesses; and the case for the appellants closed.

Mr. BALFOUR BROWNE then addressed the Bench for the respondents. He said the Committee had fully considered the position of the works, and the difficulty of maintaining them without a sea-wall; and they acknowledged that it was an exceptional case, but not such a one as the Company wished to show. Their figures were absolutely fallacious. Their annual expenses for repairs and renewals of the works came to £940, instead of the absurd figure of £1731; and £940 taken from the gross estimated rental of £4376 brought the rateable value of the whole undertaking to £3436. Mr. Davies had told them that he obtained his figures—£2556, which he fixed as the gross—from the rate-book. But this was not sufficient. He wanted to test him upon all the figures; but Mr. Davies very prudently had not brought them. What, then, was the use of discussing these figures? They could not be right in the end unless they started with the correct amount. The sum of £1320 was not accurate. Why had he taken ten years in estimating the expenditure of the Company on their works? To cover 1884, which was a year when there was exceptional expenditure. This was not fair. If he had taken the whole period from 1875, he would have found that the annual average was only £1000. He asked the Bench to regard the witness's figures as a mistake. He went on to contend that a sinking fund was absolutely unnecessary. It was perfectly absurd to say that the whole of the works would go into the sea at the end of 25 years, because the Company had spent large sums of money out of revenue, in order to maintain them so that they should not slip into the sea. The Company asked them to reduce the old rating made ten years ago; but since that time their works had largely increased, and the dividends had advanced enormously. Nevertheless the Company had the assurance to come before the Court and say that a tenant would not give any more rent, and to ask for the assessment to be reduced to £839.

Mr. *W. A. Mason*, of Messrs. Hedley, Mason, and Hedley, was then called, and was about to put in his valuation of the property, when

Mr. BOYLE objected, on the ground that his learned friend was not entitled to call any evidence varying the gross amount fixed in the rate. There it was £2556; but his learned friend now put before the Bench a valuation, and tried to show that the gross estimated rental was £4376. This was a very convenient way out of the difficulty; but it was one which he could not go. He quoted a decided case—*The Southampton Dock Company v. Southampton Guardians*—in which it was held that, in any appeal against the assessment, the respondents could not give evidence to show they had fixed the gross value too low.

Mr. BROWNE said his learned friend was not right. From the beginning to the end of that paper, they did not show the gross estimated rental. It was "gross estimated rental *plus* rates."

After some argument, the Magistrates retired to consider the matter. On their return,

The CHAIRMAN said they were of opinion that the Assessment Committee, who had put the gross assessment at £2556, could not in fairness go away from their own figures; and the ruling of the Bench was that they must consider this as the gross rental. All they asked Mr. Browne to show was why the expenditure of £1320 and £411 should not be allowed the Company.

Mr. *Mason* then proceeded to give evidence. He said he had fully considered the exceptional position of the works; and he had taken account of what would be a fair deduction to make within the meaning of the Parochial Assessment Act. The estimate of Mr. Davies—£1320—for repairs and maintenance was grossly in excess of what had been spent. It was his opinion that a sinking fund was not required. The works were in perfect order, with the exception of the gasholder tank, and one or two cracks in the walls. He certainly did not think all the works would have to be renewed in 25 years. With regard to the estimated value of the works being £15,000, his valuation was £7500. If £900 was a proper rateable value in 1885, £839 was not a proper one now. There was no doubt the Company had been very much under-assessed. A liberal allowance had been made in the new assessment for statutable deductions. He was convinced that £940 was a fair amount to allow.

In cross-examination, witness said he had valued a large number of gas-works, but had never bought or sold any. He valued for assessment purposes, and had been at it for about twenty years. He had valued other gas-works in the Island; and his valuation had been reduced, but by consent. A deduction of about 10 per cent. had been made, to satisfy the ratepayers. An appeal had never been brought against any of his valuations of water-works. He had had nothing to do with sea-walls, except to value them. His assistant measured the one at Ventnor; and he (witness) looked at it. He had no evidence that it would cost £1000 to put the wall in proper repair; as the tide was in such a state when he was at the works that he could not see the wall properly. He had never seen gas-works located like those at Ventnor.

Mr. *W. A. Vaion*, J.P., Gas and Water Engineer to the Ramsgate Corporation, said he considered £998 was sufficient deduction to make for repairs, based on the average of the three years 1890-92. He thought Mr. Davies's figure of £1320 altogether beyond what was necessary. He did not see any need for providing for such an expenditure as £1300 for a new gasholder. The sinking fund of £411 was not required. The works were in very good order; and he did not anticipate that it would cost more than he had stated to maintain them. He agreed generally with Mr. Mason's figures.

Cross-examined by Mr. BOYLE, witness said he estimated the value of the works at present at £7900. He was not aware that they cost £21,500; and, if so, he did not know what could be included in this sum. He only gave the value of the premises as they stood. He should be very glad to put them up new for £7900. He saw the crack in the gasholder tank; but he did not know what it would cost to put it in order. It ought not to be out of order if it was not originally defective.

Re-examined: He did not say the works had depreciated to the extent of £13,500; but he did say they could be rebuilt for £7900. With regard to the crack in the tank, he was not sure that it indicated defective construction.

Mr. *W. Eve*, a Fellow of the Surveyors' Institution, gave it as his opinion that £1020 should be allowed as the statutable deduction from the gross value, for repairs and maintenance. He said he had never known gas-works in such a precarious position as t hose at Ventnor.

Counsel on either side having been heard in reply, the Magistrates retired. On returning into Court,

The CHAIRMAN said they thought the justice of the case would be met by making a reduction of £1278. They did not admit the sinking fund of £411. Therefore their decision was that the rateable value should be £1288, instead of £2055. Costs would follow the decision.

Mr. BALFOUR BROWNE argued as to the fairness of the ruling as to costs, as the Company had not succeeded in establishing the whole of their claim.

The CHAIRMAN said it would not alter their decision.

Reduction in the Price of Gas at Rawmarsh.—The Rawmarsh Local Board have reduced the price of gas 3d. per 1000 cubic feet; the charges for the December quarter being 2s. 9d. to large consumers of more than 45,000 cubic feet per annum, and 3s. to small consumers. There has been an outcry (says a Sheffield contemporary) for years past as to the price charged; but the Board were powerless so long as the district was supplied by the Rotherham Corporation. Now they are their own manufacturers of gas, immediate benefit is realisable.

The Position of the Dublin Water Supply.—The Water Committee of the Dublin Municipal Council have resolved to cut off the water supply from the Royal Canal, and once more restore the Vartry water to the whole of the city and suburbs. This decision was arrived at on the report of the City Engineer (Mr. Harty) that the water in the Roundwood reservoir was now within 16 feet of the top level, and was rising rapidly. The reservoir at the beginning of last week contained 904 million gallons; and the Committee, therefore, felt themselves justified in dispensing with the auxiliary supplies.

Explosion at the Blackpool Gas-Works.—An alarming accident occurred in the purifying-room at the Blackpool Gas-Works on Sunday, the 14th inst. William Wade, who is said to be an experienced hand, placed a lighted lamp in a very dangerous position; and an explosion resulted, greatly alarming the inhabitants in the vicinity. A fellow workman named Blower was badly burned, and was not expected to recover. Wade was also burned about the arms and face, but not so seriously as Blower. The explosion, it appears, was due to the fact that the lamp which the men were using was brought right into the midst of the purifying material which was still highly charged with gas, notwithstanding that it had been exposed to the air for two hours. Wade, the injured man, who removed the lamp from its position of comparative safety, was engaged in raising a grid, and procured the light in order that he might the better see his work. Two distinct explosions are said to have occurred. All the windows, which swing on hinges, were blown outwards; but only one pane of glass in the roof was broken, and no damage was done to the plant.

The Prospective Position of the Newcastle and Gateshead Water Supply.—A deputation of the Chairmen of the various Committees of the Gateshead Corporation waited upon the Directors of the Newcastle and Gateshead Water Company on Tuesday last, with the object of ascertaining what prospect the Company had of meeting the present water difficulty in Gateshead, and what permanent provisions were in hand. The Chairman of the Directors (Mr. W. D. Cruddas, J.P.) explained that the present dearth arose through the unusual scanty rainfall of the past year, which was fully 8 inches below the average in the Hallington district. In relation to the temporary expedients for meeting a possible continued deficit, he stated that at the present time the pumping power of the Company was 6 million gallons per day, which would be increased by April to 9 million gallons, taken from the Tyne at Wylam, which analyses showed was as good for domestic purposes as the present gravitation supply. The piping to bring the Rede water to the reservoirs would probably be finished in the fall of this year; but they had no powers, under their Act of 1889, to take water from the Rede until the dam was constructed. But part of the provisions of the Bill they were now promoting in Parliament was to enable them at once, on the completion of the pipe laying, to avail themselves of the Rede water. Further, the Bill also contemplated the construction, at Cat's Cleugh, near Otterburn, of a reservoir with a storeage capacity of 2000 million gallons, which, with the existing reservoirs, would give a total of 5000 million gallons. The deputation pointed out that the ten years' period named in the Bill for the completion of the works seemed very long under the circumstances. The Directors, however, pointed out that not a moment would be lost to bring into use the Rede water supply.

The Proposed New Powers for the Torquay Gas Company.—A special meeting of the shareholders of the Torquay Gas Company has been held, for the purpose of considering the Bill which is being promoted by the Directors. In moving a resolution approving of the Bill, the Chairman (Mr. W. H. Kitson) said that, when the shareholders met together last September, he intimated that within a short period they would probably have to go to Parliament for additional powers. Looking at the requirements of Torquay and Cockington, he thought they would agree that it was necessary the Company should keep pace with the times, and be in a position to meet all the demands made on them. He was informed that a clause in the Bill that was being promoted by the Paignton Gas Company, which sought to acquire power to enter the Torquay district, had been withdrawn. It had been thought possible to bring about the amalgamation of the Torquay and Paignton Gas Companies; but although the matter had been under consideration for some time, nothing had come of it. Mr. Ball, in seconding the motion, said he had taken great interest in the proposed amalgamation of the two concerns. It was a pity they could not become one, as it would be greatly to the advantage of both towns. The Paignton Company, however, had refused even to meet the Torquay Directors, which showed the spirit with which they were animated in the matter. He felt sure that, if the amalgamation were brought about, the price of gas in a few years would be much less than now. The motion was adopted. The meeting then resolved itself into a second special meeting, to sanction the Directors' application for power to borrow £7500 under the Act of 1878. The Chairman moved the necessary resolution, and explained that the money was chiefly needed for increasing the storeage accommodation at the works. Prebendary Wolfe seconded the motion, which was carried.

MISCELLANEOUS NEWS.

THE QUALITY AND TESTING OF LONDON GAS.

In the JOURNAL last week, we commented upon an article dealing with the above subject which appeared in the *Daily News* on the previous Wednesday. The article called forth a letter from Mr. George Livesey; and this was followed last Tuesday by some editorial remarks. In view of the agitation which is now going on in London for cheaper gas, and of the inquiry which is still in progress on the subject of the standard to be used in testing its quality, we reproduce these contributions to the literature of the question.

The article in the *Daily News* was as follows:—

A very seductive proposal has been made to the gas consumers of London; and it would not be greatly surprising if it should meet with very general acceptance. It emanates from Mr. Livesey, of the South Metropolitan Gas Company, who assures the gas consumers of his district that he could put £20,000 or £30,000 a year into their pockets if he could only get the consent of Government to depart somewhat from the hard-and-fast rule insisting on what is technically known as a 16-candle gas. That he could really do so looks to be extremely probable. What Mr. Livesey wants to be allowed to do is to supply his customers with the gas that is produced from ordinary coal. This is found to have an illuminating power of something under 15 candles. This is more than a candle below what their Acts of Parliament require; and the ordinary coal gas has therefore to undergo a process of enrichment by cannel coal gas, petroleum spirit, or water gas, or something else affording the same result. Now, this enrichment is calculated to add about 2d. per 1000 feet to the cost of the gas; and Mr. Livesey says that the public do not get anything like two-pennyworth of benefit for this addition to the natural illuminating power of ordinary coal gas. He says, as we understand him, that a gas of 14 to 15 candle power, if used with proper burners, would give at least as good a light as the consumers are getting now, and might be supplied throughout the district for £20,000 to £30,000 less than is now paid. The South Metropolitan Gas Company produces something over 6600 million cubic feet of gas, and 2d. off the cost of every thousand feet would give £55,000. It is clear, therefore, that the public might really get their £20,000 or £30,000, and leave the Company an additional profit to the same amount.

Before any change can be made, however, the proposals of the Companies will fortunately have to undergo the overhauling of the Board of Trade and the London County Council, as well as that of the Gas Referees. The authority to which Londoners will naturally look most confidently to protect their interests will, of course, be the County Council. Mr. Dibdin, the Chemist of the Council, is personally not averse to any change; but he takes a standing with regard to the matter which Londoners will generally approve. The law requires a 16-candle gas; but it is notorious that the public does not get what the law requires. Throughout the Metropolis under the Council, there are 20 stations at which gas is systematically tested, and in the City there are three others. If at any of these 23 stations the gas is found to be below the standard, the Companies supplying it are liable to very heavy penalties; and, as a matter of fact, it rarely does fall below it to any material extent. But for years past, it has been perfectly well known that a full standard gas at all these 23 stations is quite compatible with a 14 or 15 candle gas elsewhere. The old Metropolitan Board of Works showed this by a series of private experiments all over their district; and the County Council have done the same. Long ago the Spring Gardens authorities would have taken, if they could, the legal power to examine the gas at any point over London, and would have enforced the penalties for insufficient lighting power wherever it was found. The difference of a single sperm candle in the illuminating power of gas all over London probably represents a value of something not far short of a quarter of a million of money; and though it cannot be said that this shortcoming is general throughout the Metropolis, it is far too common, and represents a very large sum of money, all of which the Council would for years past have saved to the public if they only could have acted on the obvious spirit of the law, instead of being bound down by its letter. Under these circumstances, the Chemist to the Council has no great objection to the proposed alteration, provided it is carried out in the proper way. As a matter of fact, over a large part of London consumers are not getting 16-candle gas. They are getting just the light of the unenriched gas—from 14 to 15 candle power. How it happens, nobody knows. It is probably attributable to the mere "cussedness" inherent in all mundane matters that, in spite of everything the Companies can do, the gas will deteriorate after it leaves the works, unless it happens to be going in the direction of a testing-station and a bogey man on duty. Mr. Dibdin thinks that, with some modification of the sliding-scale by which prices and dividends are adjusted, the unenriched gas might do very well, and that it might perhaps be expedient to dispense with the costly process of betterment, and save the money. Only he would stipulate that there shall be no mistake about the standard to be maintained, or about the obligation of the Companies to conform to the standard. The first suggestion was that the sperm candle value should be slightly lowered, so as to bring down the 16-candle standard to about the illuminating value of the unenriched gas. This, however, is strongly objected to. To call a gas having a lighting power of only about 14 or 14½ candles a 16-candle gas would only be misleading, and would serve no good purpose. Let the law frankly recognize the 14 or 15 candle power as the one to be supplied; and let the authority charged with the responsibility of seeing that the standard is adhered to be empowered to look for inferior gas wherever they are likely to find it. It should come considerably cheaper to the public; and with gas-burners so greatly improved as they have been of late years, the general lighting may be even better than it is now, and certainly a vast deal better than was obtained from standard quality gas when that standard was fixed by Act of Parliament. The public would at all events get what they are paying for; and that they are most certainly not doing under the present system.

Since this proposal has been put forth, a somewhat complicating element has been introduced into the subject by one or two new processes of gas enrichment. A process invented by Mr. W. Young, of Scotch oil fame, and now in operation in Peebles, has just been reported on by Mr. Linton, the Engineer and Manager of the Leith Gas-Works; and the results obtained from this system are said to greatly exceed those from any other process hitherto known. It is a method of gasifying oil said to yield 86 feet of 90-candle power gas from a gallon of oil. At the same time the Huddersfield Corporation, who make their own gas, have been experimenting with what is known as the Tatham oxy-oil process of enrichment, and early last month published a report, from which it appears they reckon they have saved £10,000 on their manufacture of 550 million cubic feet in the year. Instead of the 2d. which Mr. Livesey reckons it has cost his Company to bring the unenriched gas up to the legal standard, the Huddersfield gasmakers find it necessary to spend only a halfpenny. It is possible, of course, that the same results could hardly be obtained on the gigantic scale demanded by London; but here, at all events, is a practical achievement that may well give pause to the London Companies, and may well disincline those who represent the interests of the London public to any precipitate assent to new proposals. It seems just possible that, in order to get the benefit of a great part of that 2d. per 1000 feet, it may not be necessary to assent to any proposals for lowering the legal standard for gaslight. But, whatever may be the changes impending, there can be no sort of doubt that the farcical system of gas examination by law established at the present time must before long come to an end. The County Council have portable photometers which may be put into a cab and run off to any part of London for the examination of gas; and, whatever changes may be made, it is certain that they will have to be empowered to do this, and that the limitation of gas testing to 23 stations all over London will have to be abolished. It is an established fact that the Gas Companies will not bring their inferior gas to the testing-stations; and the testing-stations must therefore be taken to the gas.

Mr. Livesey's letter, which was written on the day after the above article appeared, but was not inserted in the *Daily News* till Tuesday last, was as follows:—

Your special article in last Wednesday's paper on "London Gas" implies, to put it mildly, that the Gas Companies do not act up to their legal obligations; and, as it also refers somewhat prominently to opinions of mine, I feel compelled to ask the favour of a portion of your valuable space to give some necessary information.

On the question of a change in the standard illuminating power, I have said nothing publicly beyond the general statement that the enrichment of ordinary gas *costs the consumer—not the gas company*—more than it is worth to him, even when he uses gas for lighting only; and when used for heating, cooking, domestic, and mechanical purposes, and motive power, the enrichment is a dead loss to the consumer. My contention is that the standard of London gas has, by mistake, been fixed too high; that it is to the consumer's advantage that he should be supplied with the best gas obtainable, without any enrichment, from the available supply of coal, which for London is Durham coal, and gives about 15-candle gas. I have enlarged upon this text in the form of a Memorandum, which, should the opportunity arise, is to be laid before the authorities; but it was certainly not the intention that the question should be first discussed in the newspapers at present.

When cannel coal was plentiful and cheap, enrichment of common gas was easy, unobjectionable, and reliable. But the supply of cannel is a rapidly-diminishing quantity, while the cost has become almost prohibitive; hence the numberless attempts to enrich by various methods with oil or petroleum spirit, which are more or less uncertain and objectionable, and by no means so successful or inexpensive as interested promoters of syndicates and companies assert. I exclude from this general statement the report, referred to in your article, of Mr. Linton, of the Leith Gas-Works, on the novel process of Mr. Young for making gas from oil. Should fuller and further trial prove that this process can be advantageously applied at small cost to common gas, my Memorandum will be consigned to the waste-paper basket; and the difficulty will be at an end, because the only objection the Gas Companies have to enrichment is that it unduly enhances the cost of gas to consumers, and it is to their interest to sell gas at the lowest price.

There is a very general misconception of the position of the Gas Companies in relation to the consumers. The object and the operation of the sliding-scale are greatly misunderstood, which, as its author, I am able to state, was an outcome of the coal famine of 1872-4, when gas companies generally charged the entire extra cost of coal to the consumers—the dividends not being affected at all. This was not fair; and I felt, and said, that the burden of high prices ought to be shared, and, on the other hand, any saving in the cost of gas production ought also to be shared in order to give gas companies a direct pecuniary inducement to sell gas at the lowest practicable price—in short, identifying the interests of shareholders and consumers, and really making them partners. In 1876, when, by Act of Parliament, the sliding-scale was applied to this Company, the relative proportions in which it divided savings in production was 3 to the consumers to 1 to the shareholders. Now, by the automatic operation of the system, the proportions are nearly 6 to 1—a saving that enables the Company to reduce the price 1d. per 1000 feet, gives the consumers in the Company's district £28,000 a year, while it only entitles the shareholders to £5000 in the shape of an increase of dividend. Whatever economies or savings, therefore, can be effected, cannot benefit the shareholders unless and until the price of gas has been reduced; and, on the other hand, whatever tends to increase the cost of gas has to be paid for in the same proportion—viz., £28,000 per penny by the consumers, and £5000 by the shareholders. Shortly, it comes to this: If the quality of the gas is to be increased, the consumers must pay nearly six-sevenths of the cost. Happily, with the exception of the last year or two, due to the increase in the price of coal, the price of gas has uniformly moved downwards since 1876 in the consumer's favour. You say that "a very large sum of money . . . would for years past have been *saved* to the public" if the gas had been

increased in light-giving power to the extent of the shortcoming which is said to be shown by that unreliable and illegal instrument, the portable photometer. This is not correct; for, instead of saving, the public would have had to pay the cost of enriching the gas in the above proportions, amounting to at least 2d. per 1000 cubic feet, and to a total in this Company's district of £56,000 a year, and to something like a quarter of a million of money for the whole of London, for a practically inappreciable advantage, which would give them what they call "dirty" or smoky gas. The portable photometer would therefore be a losing instead of a saving game to the public.

This brings me to the most serious part of your article. You say: "Over a large part of London, consumers are not getting 16-candle gas. They are getting just the light of the unenriched gas—from 14 to 15 candle power, . . . unless it happens to be going in the direction of a testing-station, and a bogey man on duty," where you admit that the quality "rarely does fall below it" (the standard) "to any material extent," which is a suggestion that the Gas Companies contrive to send gas of the proper quality to the testing-places, while they supply the consumers generally with gas of an inferior quality. I have already shown that, even if this were so, the consumers, under the operation of the sliding-scale, would get the gas at a corresponding lower price, and that they could suffer no loss; but the following considerations will, I think, prove that it is impossible. Some of the testing-places are situated on the lines of large leading mains, which convey enormous volumes of gas to the consumers, ranging from 50,000 to 250,000 or more feet per hour, out of which a continuous small stream of perhaps 50 feet an hour is withdrawn for testing, which cannot be otherwise than a fair sample. Moreover, it is the only possible way in which large volumes of gas can be tested. But, in order to see that in the extreme parts of the district the gas is of the proper quality, the Referees have fixed some of the testing-places on small outlying mains as far as possible from the gas-works; and in these situations again the tests almost invariably show that the gas is well above the standard, while we are told that the portable photometer generally gives inferior results wherever it is used. The question naturally arises: How is this? To which the only reasonable answer is that the portable photometer is as unreliable as it is illegal. In the first place, it is necessary to state that so many errors are possible, and almost unavoidable, in photometry, that only the most perfect apparatus, used under the most suitable conditions, can be approximately relied upon. Then it must be remembered that light cannot be weighed like coal or measured like water, or by a yard stick. In short, exactness is unattainable. There is what is called the "personal equation"—men's eyes differ in comparing two different lights. Then there is unconscious bias. It is easy for a man, without the slightest intention to be unfair, to make a difference of quite half a candle in reading the test. There are differences of temperature, which, in a legally authorized testing-place, are reduced to a minimum. But this is not possible with the portable photometer; and variations of temperature materially affect the result. There are also quite unexplainable discrepancies where, with the same gas in the same house, one photometer gives a result at least a candle lower than another photometer in another room. Again, there is no agreement as to the amount of light given by an average candle. By using different candles or from different makers, the same gas may be made to appear to be of either 14 or 16 candle power. Further, the gas itself is subject to unavoidable variation. If it passes through a local cold piece of pipe, some of the richer light-giving properties crystallize out of the gas in the form of naphthalene, which is deposited in the pipe; and, again, gas that has remained stagnant in the pipes for any time also has its light-giving power reduced. Now, both these causes of depreciation are avoided at the legal testing-stations. But with the portable photometer they are very likely to operate; and these are, no doubt, amongst the reasons why that instrument gives lower results. But it is not right to take stagnant gas, or gas depreciated by the deposit of naphthalene in the service-pipe, as a fair sample of the whole. With all these difficulties and uncertainties, the Gas Companies refuse to accept the indications of any but the most perfect photometrical apparatus. They have, therefore, consistently and firmly refused to recognize in any way the portable photometer; and, in thus acting, they have protected the interests of the consumers as well as, and to a greater extent than, their own. They protest against the manner in which this apparatus has been used, and to the publication of the results—which are not substantiated by legal instruments—to their disparagement.

If the public want richer gas, they can have it by paying for it; but they do not want it. What they desire is an abundant supply of cheap gas, not only for lighting, but for the multitude of other purposes for which gas is used. Their complaints are almost invariably caused by deficiencies of supply or of pressure, which are generally due to an accumulation of naphthalene in the service-pipe, and which can no more be prevented than, for the same reason—a reduction of temperature—water can be prevented from freezing. The Gas Companies have every inducement to supply cheap gas, both pecuniarily and in order to hold their own against their competitors; and the public interest demands that the public authorities should work cordially with the Gas Companies in this direction, and not put obstacles in their way.

A great fuss is made about a paltry 6 per cent. of light, more or less, when the public frequently use the cheapest and most unsuitable burners, whereby the light is reduced in many cases as much as 50 per cent. On the other hand, burners are available for practical use which increase the light 50, 100, and even as much as 300 per cent.; thus converting 16-candle gas into 24, 32, and nearly 50 candle respectively.

Last Wednesday, the *Daily News* contained the following remarks on Mr. Livesey's letter:—

"Your special article in last Wednesday's paper on 'London Gas,'" said Mr. George Livesey, in a letter in yesterday's *Daily News*, "implies, to put it mildly, that the Gas Companies do not act up to their legal obligations." The article most undoubtedly did do so; and to-day we repeat explicity and emphatically that a large proportion of the gas supplied to Londoners does not come up to the proper standard. "You say," continues Mr. Livesey: "'Over a very large part of London, consumers are not getting 16-candle gas. They are getting just the light of the unenriched gas—from 14 to 15 candle power, ... unless it happens to be going in the direction of a testing-station, and a bogey man on duty,' where you admit that the 'quality rarely does fall below the standard,' which is a suggestion that the Gas Companies contrive to send gas of the proper quality to the testing-places, while they supply the consumers generally with gas of an inferior quality." We believe they do; and the grounds of that belief were clearly stated in the article referred to. As was stated, there are 23 fixed testing-stations; and at all these the requirements of the law are found to be complied with. The old Metropolitan Board of Works and the present London County Council have been for many years past in the habit of taking a portable photometer into various districts of London at a distance from the testing-stations; and, wherever they go, they find, as a rule, the gas is below par, and in some districts—and reference to the records of these experiments will show that it is especially true of the South Metropolitan district—the deficiency is very serious. As we said in the last article, the difference of a sperm candle in the gas consumed by London would represent not much less than a quarter of a million of money. Yet the portable photometer will often show a deficiency throughout a district amounting to one, two, or even three candles. Now, Mr. Livesey does not deny that the portable photometer shows this; but he says that the Companies have consistently and firmly refused to recognize in any way the portable photometer, which he says "is as unreliable as it is illegal." The truth is, on the contrary, that the instrument is perfectly legal and absolutely trustworthy. It is legal for the County Council, or for anybody else, to test the quality of the gas supplied to the public in any way they think proper; and that the appliances which the County Council and their predecessors have continually employed for the purpose for years past are quite as trustworthy as those at the fixed stations, has been shown in a way that is absolutely convincing. The fixed stations themselves have afforded indisputable means of verifying them. There was a time when, of course, the peripatetic photometer had to be verified. Its reliability had to be tested; and this was done in scores and hundreds of cases. It would be taken first of all to a board school, a vestry hall, a fire brigade station, or some such place, where gas is freely used, and the gas would be tested by it. Then it would be hurried off to a fixed station, and there the gas would be tested both by the fixed and by the portable instrument; and invariably it would be found that the readings were identical. Even now, if in any district there is an exceptionally low standard of gas, the moveable instrument which records it is taken away and verified by the one at the station. The two things are always found to be practically the same. Now, is Mr. Livesey prepared to dispute this, and to have the matter publicly tested? If not, what is the use of the Companies "consistently and firmly refusing to recognize in any way the portable photometer?" The accuracy of the instrument is capable of the simplest possible test; and if, instead of insisting on having it tested, they "consistently and firmly refuse to recognize it," how is it possible to escape the conclusion that they are afraid of its evidence? They know perfectly well that this evidence proves beyond all reasonable doubt that Londoners are not getting all they ought to do for their money; and Mr. Livesey undoubtedly states the real reason when he says: "The supply of cannel coal is a rapidly diminishing quantity, while the cost has become almost prohibitive.' It is easy to admit that that fact certainly does afford good ground for reconsidering the quality of the gas required to be supplied to Londoners; but so long as the law requires the Companies to supply a 16-candle gas, the fact that the materials are becoming expensive does not afford the slightest justification for foisting upon consumers a gas two or three candles lower in illuminating power wherever the testing-stations can be avoided. We believe that the contention of the County Council is indisputably the correct one—that the law should set up a proper standard, and that the companies should be required strictly to adhere to it.

Mr. Livesey sent a short letter in answer to some of the statements contained in the foregoing article; for to reply to them fully would, he said, be simply to re-write his letter of the 11th inst., given above. He therefore contented himself by saying that no gas in the world is tested so severely as the London gas; and he ventured to affirm that none came out of the ordeal more satisfactorily. "The Gas Companies are required to supply gas of a certain quality, tested in a certain manner according to Act of Parliament; and I do not hesitate to say it is not fair to tell the public that the Companies do not act up to their legal obligations when, as the legal tests always show, the terms of the Act have been uniformly complied with, and more than complied with." In support of this statement, Mr. Livesey enclosed with his letter a copy of the Chief Gas Examiner's report for the past quarter. He then went on to say: "If the public wish the gas to be tested in another way, the effect of which would be to necessitate an increase in the illuminating power, they must pay for it. If the power is increased, there is no possibility of saving, as you put it, to the public; but they must bear at least six-sevenths of the cost. Taking the case of this Company, if the quality of the gas had to be raised in the proportions named by you from something under 15 to 16 candles, we must raise the price 2d. per 1000 feet, which would amount to £56,000 a year out of the consumers' pockets; and as we are not now paying our full dividend by ¼ per cent., the increase in price of 2d. would only entail a reduction of ¼ instead of ½ per cent. of dividend, or exactly £5350 a year. If the gas, therefore, were below the required standard, there would be no loss to the consumers, because they would get it at a proportionately lower price."

The Rochdale Water Committee and Lead-Poisoning.—Recently the medical practitioners of Rochdale have drawn the attention of the Water Committee to certain aspects of the question of lead poisoning. As the result, the Committee have resolved "that every consumer's pipe not being made of cast-iron and not being authorized or permitted in writing by the Corporation, must be a pipe which will protect the water from contamination by lead, and be approved of by the Corporation."

THE GAS QUESTION IN DUBLIN.

Alderman Gill Defends the Alliance Gas Company.

At the Meeting of the Dublin Municipal Council yesterday week, Alderman Gill sought to make a personal explanation in connection with the gas question. In asking the permission of the Council to do this, he said that, under ordinary circumstances, as a Director of the Gas Company, he should not interfere; but matters had gone so far as to the subject of the testing of the gas that there was practically an accusation of fraud made against him, Alderman Kernan, and other gentlemen who sat with him as Directors of the Company. The ex-Lord Mayor (Mr. J. Shanks), who was presiding, interrupted with the remark that he could only listen to this statement with the consent of the Council; and then ensued a three-cornered discussion between Aldermen Gill, Mulligan, and Mead, as to the right of the first-named to be heard. It was mentioned by Alderman Gill that the statement of which he complained was made against him by an official of the Corporation, and that it arose out of proceedings in the Council. The ex-Lord Mayor observed that he would have no objection to hear Alderman Gill; but he did not see how he could go into this matter without entering into the whole case. A report on the gas question would be before the members at the next meeting; and surely the reputation of Alderman Gill was sufficiently established to make it very easy for him to afford to wait for a week. Alderman Gill said he was not going to push the request; and he was just as glad that the Council refused to let him make the statement. He would publish it; and the public could judge between him and the gentlemen who had refused to hear him.

On the following day, Alderman Gill published his statement. It was a very lengthy document, addressed to the Lord Mayor. In the opening sentences, he said that, under ordinary circumstances, as a Director of the Gas Company, he should not interfere in questions relating to gas; but matters had now gone so far with regard to the reports of gas testing, as published in the papers by the Corporation Inspector of Public Lighting (Mr. T. J. Cotton), that there was practically an accusation of fraud made against him, Alderman Kernan, and the other gentlemen who acted with them as Directors of the Company, exactly as if a contractor bound himself to supply pure milk to a public institution, and sent it in largely adulterated with water. The statement proceeded: "Quite recently, on the following dates, the testings published by Dr. Tichborne and by the Inspector of Public Lighting were—

		Inspector of Public Lighting.		Dr. Tichborne.
1893,	Dec. 19	13·4 candles	..	16·73 candles
	Dec. 22	13·3 ,,	..	16·38 ,,
	Dec. 23	13·2 ,,	..	15·12 ,,
1894,	Jan. 1	13·8 ,,	..	16·08 ,,
	Jan. 4	12·3 ,,	..	16·50 ,,

Such discrepancies could, I believe, only occur through one of the gentlemen not knowing how to test properly, or by one of the gentlemen deliberately giving wrong testings with the object of damaging the Gas Company in the eyes of the public, and thus virtually accusing me and the other Directors of the Company of dishonesty by supplying gas to the citizens of Dublin of about 20 per cent. less illuminating power than that at which they profess to give it, and at which they are bound by Act of Parliament to give it—viz., 16 candles. Dr. Tichborne is a gentleman of long practice and high scientific attainments, appointed by the Board of Trade to test the gas, in order to see that the Gas Company supplies the proper quality. I say nothing about the competency of the Inspector of Public Lighting, but let the following facts speak for themselves, and allow the members of this Council and the public to base their judgments on them."

In March of last year, the Paving and Lighting Committee appointed a Sub-Committee to visit the testing-station in Tara Street and see the testing operations both of Dr. Tichborne and of the Inspector of Public Lighting. Having visited the station, they reported to the Committee that, at the hour of their visit, they found Professor Tichborne was in occupation, and was engaged in testing. They therefore invited him to show them the process adopted by him, which he readily and courteously consented to do. "Dr. Tichborne," they said, "made his process quite plain to us. He first ascertained the temperature, 64°, indicated by the thermometer attached to the testing apparatus, and the barometrical pressure, 30·3 inches from a barometer in the room, and reference to a printed tabular form showed opposite to these figures the tabular number 1000. With this tabular number to start with, no allowance or adjustment had to be made in the final calculation, as would have been necessary had the temperature or barometrical pressure been materially less or more than 64° and 30·3 respectively. It is unnecessary to describe the operation in detail; but Dr. Tichborne made observations every minute, and recorded these in figures on a printed form where we could all see it. The observations lasted for ten minutes; and when the tenth was recorded, the calculation of the illuminating power was made. The time occupied in testing and in explanation was twenty minutes; and Dr. Tichborne then took his departure, and Mr. Cotton prepared to make his test, with the same apparatus as Dr. Tichborne had used. Having taken his seat in front of it, he volunteered no information whatever; and there was complete silence for five minutes. He was then asked when he would begin to test. He replied that the candles which he had lighted would not burn properly for ten minutes. He was very soon afterwards observed two or three times to make entries in a book; and he was then asked was he testing. He replied that the test had been going on for some minutes. He was remonstrated with, and requested to keep us informed of what he was doing, and to enter his observations on the printed form used by Dr. Tichborne, or on the back of the form, which was blank, so that they could follow his action. He positively refused to do this or to do anything except test the gas in what he referred to as his usual way. He also refused to call out the figures when entering them in his book, in order that one of us might make a note. Again remonstrated with, he consented to begin the test over again; and he called out the figures, which were then noted by the Lord Mayor, and no questions were asked until the observations were completed. In reply to the Lord Mayor, he admitted that the test had been carried out under proper conditions. Mr. Cotton did not use the time indicator on the testing apparatus, but took the time from a clock in the room. He did not, prior to testing, take the indications from thermometer and barometer; and, when asked about this, he stated he would take them *after* testing. At the end of the testing, he was again reminded, and he stated he intended to take three or four additional testings before looking at the thermometer and barometer; but when pressed, he took the indications then. He refused positively to make or show his calculation of the illuminating power. When taking the ten observations of illuminating power, Dr. Tichborne steadily adjusted the slides containing the discs; and it was quite easy to read with him the indicated figures. While at this part of the process, Mr. Cotton moved the slide backwards and forward so rapidly as to render it impossible to read the figures. We append the figures given us by each of the operators. It will be observed that the variations of illuminating power during successive minutes vary but slightly in Dr. Tichborne's list, while they vary considerably in Mr. Cotton's; and that inside the same half hour, and working with the same apparatus, the illuminating power was calculated by one at 16·98 candle power, while Mr. Cotton's observations resulted in 15·67. We are of opinion that the Committee should take steps to put an end to the constant conflict of testimony between the Board of Trade Inspector and the Corporation Inspector. One or other, or both, must evidently be guilty of error in the reports made. We feel it to be our duty to add that Mr. Cotton's conduct in the, testing-room was not only discourteous but disrespectful; and, in factt defiant of the order of the Committee, and that he deliberately set himself to baffle our inspection." The testings subjoined to the report were as follows: Dr. Tichborne's tests—Consumption of sperm by two candles in ten minutes 40·4 grains: 1st minute, 8·4; 2nd, 8·4; 3rd, 8·4; 4th, 8·4; 5th, 8·4; 6th, 8·4; 7th, 8·4; 8th, 8·3; 9th, 8·5; 10th, 8·5—84·1 × 40·4 = 339764, divided by 2 = 16·93-candle power. Mr. Cotton's tests—Consumption of sperm (not supplied), taken at 40·4 grains: 1st minute, 7·7; 2nd, 7·8; 3rd, 7·5; 4th, 7·8; 5th, 8·1; 6th, 7·8; 7th, 8·0; 8th, 7·7; 9th, 7·5; 10th, 7·7—77·5 × 40·4 = 313504, divided by 2 = 15·67-candle power.

As this report was put into type, Alderman Gill has no doubt it was first intended to forward it to the Council. The following reply to it (dated April 17, 1893) by the Inspector of Public Lighting was also put into type: "It is with extreme regret that I read the Sub-Committee's report on their visit to the Gas Company's testing-place. I beg to say that I have discharged my duties faithfully, and with an anxious desire to protect the interests of the Corporation; and I point to the records of my work to prove this. I offered no opposition to the inquiry when it was demanded by the Right Hon. the Lord Mayor and Councillor Robinson, although, in my opinion, it was without precedent; such work being always done by qualified experts. I make my tests in a conscientious manner, and report the illuminating power of the gas as I find it; and up to this they have always been relied on by the Corporation. It is stated I did not use the time indicator on the testing apparatus. I respectfully say that this is an error. I not only used the experimental seconds clock, which stood on the photometer table, but also used in my hand a small seconds clock belonging to the Corporation for the purpose of checking that of the Company. The calculation given in the appendix of the report is not mine; the assumed figures not being correct. Therefore I must decline being responsible for it. I hold my certificate of qualification as gas examiner from the Board of Works; and my testings were performed according to certain rules which are clearly set forth in the Act of 1871. Had I conducted them in the manner required by the Sub-Committee, I would have differed from those rules. I most distinctly and emphatically state that I had no intention whatever to offer disrespect or discourtesy to the Sub-Committee. If anything took place while I was absorbed in my work at the photometer, which may have led them to think so, I am sorry for it." The Paving and Lighting Committee considered this reply on April 25, and made this order: "Inspector of Public Lighting to be informed that Committee regard his reply as quite unsatisfactory, and must call upon him for an ample apology for his disobedience to the order of this Committee and for his conduct in the testing-station." Mr. Cotton afterwards sent the following apology on May 15: "I most respectfully express my regret that my last letter was not considered an adequate apology. I again wish to state that I meant no discourtesy, and that I am sincerely sorry for any action of mine that has given displeasure to the Sub-Committee. Trusting your Committee will accept this apology in the spirit I now offer it."

Alderman Gill concludes his statement by saying: "On the motion of some of the members, it was resolved not to send a report to the Council. Some time ago I obtained a copy of each of the printed documents, which were easily procurable when the matter was before the Paving and Lighting Committee; and I should not have made them public now were it not for the persistent publication by the Inspector of Public Lighting of testings of the quality of the gas which I know to be grossly inaccurate. The person occupying his position as gas examiner, in which capacity he tests the gas, should, according to the Act of Parliament, be 'a competent and impartial person, and test the gas at the testing-place provided in conformity with the provisions of the Act.' I think the public will see at once that Mr. Thomas Cotton could not possibly be considered an 'impartial' person, when they learn that he is paid by the Corporation for three other positions—viz., Inspector of Public Lighting; Inspector of Meters, under the Sale of Gas Act; Secretary to the Private Gas Committee, which has persistently shown very great hostility to the Gas Company."

Mr. Mayne Defends the Corporation Gas Examiner.

The following letter from Mr. T. Mayne, a former member of the Town Council, dealing with Alderman Gill's statements, appeared in the *Freeman's Journal* last Thursday:—

On reading Alderman Gill's complaint of the amount of difference shown in the return of the two Gas Examiners in Dublin as to the quality of the gas supplied in the city, I feel constrained to ask him what he has done, as a Director of the Gas Company, to bring about the possibility of a closer agreement in these returns.

The Corporation Gas Examiner, with whose returns he finds fault, makes his testings with a photometer purchased by the Gas Committee of the Corporation, of which I have been until recently a member. This instrument is one of the best and most modern that could be procured; and yet, notwithstanding this, the Gas Committee had it sent to the Standards Department of the Board of Trade for verification, and stamping if found accurate. It was found accurate, and stamped by the Department. The Committee requested the Gas Company to send the photometer that they were bound to place in the public official testing-room of the new gas-testing station in Tara Street similarly to the Board of Trade for verification and stamping, before having it used for testing purposes. This request the Gas Company refused to comply with. The Committee pressed their view that the gas testing in the official testing-room should be done on a certified instrument; but failed to obtain from the Gas Company compliance with their request.

A deputation from the Gas Committee then waited on the Chief of the Standards Department of the Board of Trade, with the object of getting the Board to compel the Gas Company to provide a properly tested and stamped set of instruments in the public testing-room. He stated to the deputation that the Board of Trade had no legal power to do so. He said that all, or nearly all, gas companies did submit the photometers intended for use in official testing-stations to his Department for verification; but if the Dublin Gas Company refused to do so, they had no power to compel them. He asked what type of instrument the Gas Company had actually provided in the official testing-room; and when told that it was an old Evans photometer having moveable candles, he said the Board of Trade could not verify, or recognize in any way, instruments of that type; that they were "obsolete and unreliable;" and that two competent gas examiners testing the same gas with old instruments of that type might easily get a difference of one to two candles in their returns. I was a member of this deputation, and was astounded at these statements made by so high an authority.

I would ask Alderman Gill: How can he expect testings done on two sets of instruments so dissimilar to agree? And, further: Is the remedy not obvious—viz., for Alderman Gill and his brother Directors of the Gas Company to have the "obsolete" instrument removed from the official testing-room, and replaced by a modern one, verified and stamped by the Standards Department of the Board of Trade?

As to the visit of the Sub-Committee of the Paving Committee to the old testing-station on Burgh Quay, which Alderman Gill drags into his statement, I can assure him that the Sub-Committee simply wasted their time. They went ostensibly to see how the two Gas Examiners did their work, and to sit in judgment on them. None of them had ever seen gas tested before; so that they were not even amateurs in the art or science of gas testing, and, further, knew nothing whatever of the elaborate calculations that have to be made after the testing is apparently over. The Corporation could, if they wished, take a more practical method of testing the accuracy of their Gas Examiner. If they employed some well-known and experienced gas examiner, not in the pay of any gas company, to test on one of the two verified photometers that belong to the Corporation, while the Corporation Gas Examiner tested on the other, the result would, I expect, satisfy everyone of what the Gas Committee have been convinced for a long time—that the Corporation have a very valuable officer in their Gas Examiner, Mr. Thomas J. Cotton.

I was very much pleased to be able to infer, from Alderman Gill's statement, that gas questions are likely to be discussed in the Corporation for the future without the interference of members of that body who have an interest in the Gas Company. Such a course will probably enable these discussions to be carried on without the needless friction that seems to be their inevitable accompaniment. I accept his statement as an evidence that he agrees with me in the wisdom of the motion which I originally drafted, and which I hope to see carried with his concurrence—viz., that of appointing a Lighting Committee on which members of the Corporation who have an interest in any lighting company should not sit

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This letter was followed by replies from Alderman Gill and from the Secretary and General Manager of the Gas Company (Mr. W. F. Cotton, J.P.), as well as by a rejoinder from Mr. Mayne. These must be left for notice next week.

MANCHESTER CORPORATION GAS SUPPLY.

The Proposed Extensions at the Gas-Works.

Last Tuesday, an inquiry was held in Manchester, by Mr. ARNOLD TAYLOR, one of the Inspectors of the Local Government Board respecting the Corporation's application for power to borrow £250,000 for the extension of the gas-works. To some extent, the inquiry was of a formal character. Under a Provisional Order of last year, the Corporation are enabled to extend their borrowing powers for gas-works purposes by sums not exceeding £500,000, subject, however, to the sanction of the Local Government Board as the different amounts making up this total are required. On the 8th of March, 1893, the late Mr. J. Smith, one of the Board's Inspectors, held an inquiry relative to the application of the Corporation for power to raise £250,000. He, however, died before the matter was concluded; and the present inquiry was necessary to complete the report. In the meantime, some changes had been made in the Gas Committee's plans.

The TOWN CLERK (Mr. W. H. Talbot) having made a short statement,

Mr. J. BROOKS, Chairman of the Gas Committee, gave evidence as to the manner in which it is proposed to expend the £250,000. At the Bradford Road station, there is to be a total outlay of £114,401. Of this sum, £28,897 is the estimated cost of the tank, 254 feet in diameter and 50 ft. 6 in. deep, and the new gasholder referred to in the last number of the JOURNAL. The three-lift holder, with a capacity of 7 million cubic feet, is to cost £33,958; the inlet and outlet pipes, £2237; and £5000 is set down for "probable additions—extras under schedule." Among other items is £7760 for the stoking machinery in No. 2 retort-house; £10,000 for machinery for No. 1 house (including the strengthening of the floor); £5552 for purifying-house, purifiers, and elevators; £1658 for a station meter; £1387 for a washer-scrubber; and £1288 for a condenser. Other works contemplated are: Manager's house, offices, and stables, estimated to cost £6600; a new river-wall, £3000; railway stage, £2247; locomotive engine and self-tipping waggons, £1500; two new boilers, £580; and exhausters and engines, £675. A sum of £2062 is added for sundries. At Gaythorn works, the only addition at present in hand or contemplated is a new holder, with a capacity of 1½ million cubic feet. This is to have three lifts; and the tank is to have a diameter of 150 feet, and a depth of 30 feet. The contracts are: For the tank, £9253; pumping and extras, £2030; holder, £11,144; inlet and outlet pipes, £377; and probable additions, £2500—making a total of £25,304. The estimated expenditure at the Rochdale Road station is placed at £34,720. Of this sum £25,000 is put down for the reconstruction of the B retort-house, including fittings and machinery; £6000 for new purifiers; £2000 for scrubbers; £1000 for carburetting plant; and £720 for a boiler. An addition is also to be made to the storeage and manufacturing plant at the Droylesden works. The new holder there is to be of the capacity of 600,000 cubic feet. The contract for the tank, which is 100 feet in diameter and 24 feet deep, was let for £2894; and the extras are put down at £575. The contract for the holder amounts to £3970. The additions to the plant cost £3593; and the land for the extensions, £3500—making the total cost at this station £14,532. These items, amounting altogether to £188,757, comprise the intended additions to the manufacturing and storeage plant. With regard to distribution, £30,000 is required for mains, service-pipes, &c., in the three years ending 1895; £15,000 for ordinary and prepayment meters; and £11,700 for stoves, including £7700 the estimated cost of a show-room and the land on which it is to be built. To bring up the total to £250,000, a sum of £4343 is added for miscellaneous works. On the question of the length of time to be allowed for the repayment of the loan, Mr. Brooks said the Corporation would like the period to be fixed at 55 years.

The INSPECTOR pointed out that the previous Order specified that the money borrowed should be repaid in a period "not exceeding 50 years from the date of the borrowing;" and he said he thought there might be some difficulty in getting the time extended, though he would certainly support the desire of the Corporation.

Alderman GIBSON, Deputy-Chairman of the Committee, remarked that, if a short period only were allowed, the burden would press heavily on the existing community, to the advantage of those who followed them.

Mr. BROOKS, replying to a question as to the depreciation of the works, said the Committee had depreciated the value of their works excessively. This was so much the case that they abandoned the depreciation account two or three years ago, and established a renewals account in its place. In his opinion, the works had been depreciated to one-half their present value.

Mr. C. NICKSON, Superintendent of the Gas Department, remarked that this related for the most part to the permanent works, which were kept in good repair out of revenue; besides which, the sinking fund was set aside for the repayment of the money borrowed.

The LORD MAYOR (Alderman A. Marshall) referred to the large and important works which the Corporation have on hand in connection with the Thirlmere water scheme, the loan to the Ship Canal Company, and the main drainage scheme, and said it was most important that the repayment should be distributed over a long period in order that the present generation might not be unduly burdened. The Gas Committee, he added, had done their work well in the past, and should not be unduly restricted in the present instance.

The INSPECTOR expressed his concurrence with this opinion, and said his feeling was with the local authorities; but at head-quarters the tendency was against long periods. Both Parliament and the Local Government Board were opposed to the granting of the terms which were formerly allowed; but personally he thought that more than 30 years should be sanctioned.

It was arranged that the Inspector should visit the Bradford Road works; and, in closing the inquiry, he promised to report to the Local Government Board on the subject without delay.

THE WIGAN OUT-TOWNSHIPS AND THE PRICE OF GAS.

The Wigan out-townships are not taking at all kindly to the advance which it is proposed to make in the price of gas. Both the Ince and the Pemberton Local Boards have already expressed their emphatic disapproval of the course which the Corporation are pursuing. At Pemberton the members of the Local Authority contented themselves with recording their protest, and the expression of the opinion that, in view of the monopoly which the Corporation enjoy, they should supply gas to Pemberton at the same price as to consumers in the borough. A differential rate of 6d. is in operation; and, at the enhanced price, gas is sold at 3s. 3d. per 1000 cubic feet within a mile radius of the gas-works, and at 3s. 9d. beyond that area. This is also felt as a grievance at Ince; but there the Local Board are disposed to complain as much of the reasons given for the advance as they are of the advance itself. The cynical admission of the Chairman of the Wigan Finance Committee, that the price has been raised in order that gas consumers who are not ratepayers may contribute to the rates, is strongly resented. When the matter was mentioned at the last meeting of the Ince Local Board, a member at once suggested that they should take the lead in an agitation against the Corporation, and invite other local authorities concerned to co-operate with them in any steps which it might be desirable to take to keep the price down. The Chairman thought a more effective course would be for a Committee to consider with the legal adviser of the Board as to their power to supply the township with gas or the electric light. In his opinion, Ince ought not to be called upon to subscribe for the maintenance of the streets of Wigan or the keeping up of its Sanitorium. The ratepayers of Ince had to do these things for themselves; and it was a dishonest

policy, he said, on the part of Wigan, to call upon outsiders to pay a proportion of the money which they had spent on their own institutions. If there had been a loss on the gas-works at Wigan, it would have been the duty of the Ince consumers to have subscribed towards the deficit; but when the works were making a profit of £2000, besides adding to the sinking fund, it was not fair to call upon the outside local authorities. The deficit they were asked to make up was not due to the gas undertaking, but to the extravagance of the Corporation in the expenditure upon its Sanitorium. Other members endorsed the Chairman's view of the matter; and, in the end, a Committee was appointed to consider the position of the Board in regard to the lighting of the township.

MR. B. PICKARD, M.P., ON WORK AND WAGES IN THE COAL TRADE.

In opening the Annual Conference of the Miners' Federation of Great Britain at Leicester last Wednesday, the President (Mr. B. Pickard, M.P.) devoted a large portion of his address to the above subject. He congratulated the members of the Federation upon preserving their wages intact while other communities have suffered heavy reductions. Although buffetted and tossed about by the unsettled condition of trade in other localities, the Federation, he remarked remained as firm as a rock. Their leaders received continual abuse. They had made up their minds that, having fought for and obtained a living wage, they were not going to allow the middleman, the coal-owner, or the commercial agent to bring the wages down to the point they were at before 1888. They had seen the distress in every mining village, and had come to the conclusion that, if colliery owners and managers, and those who stood between them and the general public, were determined to give away the profits of the employers and the bone and sinew of their men, then it must be done at the point of the bayonet, because they themselves believed that the prices of coal could be so arranged and maintained as to give to them and to the men profits and wages equal to a living rate continuously. They believed that the general public had no right to be mulcted in heavy rates, while the monopolists of the various communities representing railways, gas companies, and the general trade consumers of the country should go scot free in the way of paying a fair and a reasonable price for the coal. Any class of trader, any manufacturer, or any class of consumer who desired coal below the price at which it could be fairly produced, should be made to feel that they were not entitled to any consideration at the hands of either colliers or colliery-owners. Colliery-owners had offered to sell in the market at a price which they knew would not cover the cost of production, even if their workmen gave all their work free. That way and manner of selling coal could not be considered to be fair trading, or trading such as to bring about a mutual return either to colliery owners or workers. If the coal-owners could always get their prices from the general public, why not also from the gas companies, railway companies, and the iron monopolists? It was because the coalowners were mixed up with the companies; and it was putting money into one pocket after taking it out of the other. He then discussed the prices paid for coal in great towns, and said that, when it was remembered that during the recent lock-out the coal was advanced to the poor people in the suburbs of London to something like 50s. per ton, it was enough to make one's hair stand on end, because, during the whole of the time the lock-out continued, not one penny more was paid for the coal that was procured than was paid before the stoppage. Coal that was sold at from 12s. to 13s. per ton, delivered within a radius of 20 miles of collieries in Yorkshire, Derbyshire, and Nottinghamshire, was sold in London at 2s. 2d. per cwt. during what was called the "coal famine" consequent upon the continued lock-out. When it was understood that 15s. per ton would more than cover the cost of getting, the cost of demurrage, and the cost of carriage by railway to the points of delivery in the centres of the working classes of London, they would find that for every ton of coal, the merchant in London, or the colliery-owner who dealt direct with London, obtained at least 15s. or 16s. as clear profit. No working man, no middle-class man, and no rich man, even with his thousands a year, should be called upon to pay such an exorbitant price at any time or under any circumstances, either in the Metropolis or the provinces; and the only way for the people of London to meet the difficulty was to form, along with others, co-operative coal-selling associations on the principle that no profits should obtain.

With regard to the outlook in the coal and other industries, Mr. Pickard stated that the coal trade was never so prosperous as at the time when colliery-owners demanded a reduction in the men's wages. In the iron and steel industries, dividends ranked very high, as they did in collieries, banking companies, and breweries. He enumerated several such companies which were paying from 5 to 28 per cent. It was a parrot-cry that every company was going to the dogs. Yet while these companies were doing such a roaring and profitable business, they had the hardihood to encourage each other in pulling down workmen's wages. He then referred to those miners who had for a time belonged to the Federation and had then abandoned it. The leaders in the North twitted them, he said, on two special grounds. The first was that they had started a theory that was a chimera; the second, that, when they were put to the test, they should be nowhere, but be "knocked into a cocked hat." The chimera had proved to be an oasis in the desert; and the cocked hat remained as firm to-day as it was before it was knocked. It other words, the Federation started out with the grand idea to raise the value of wages, so as to create a fund which would give to its members a living wage; and that living wage was obtained. A general demand to lower that living wage was made upon them. They had fought; and although some few had fallen in the battle, and wounds had been received which might never be healed, still at the same time the spoils of victory remained with them. Almost identical terms were arranged at the Rosebery conference as were suggested to the colliery-owners at the Mayors' conference in Sheffield. He was able to inform them that the colliery-owners were prepared to accept suggestions from outsiders which they would not accept from himself and others on their side of the House. On that memorable 17th of November in the Foreign Office, they were not long before they found that they had a gentleman to deal with who would strike the balance fairly. The suggestions that he made to the 28 representatives present were of such a character as immediately to bring about their acceptance by the men's representatives, at all events; and an agreement was ultimately entered into that the men should return to work immediately, so far as was practicable, at the old rate of wages. That agreement had been, on the whole, very fairly carried out. He thought all praise and credit were due to his Lordship for conducting the business in such a way as to bring about so peaceable a settlement of one of the most awful and protracted lock-outs which had occurred during this century. He hoped that a minimum wage would be agreed upon, and that a permanent Board of Conciliation would be arranged.

Referring to the subjects for consideration at the conference, Mr. Pickard said the Eight Hours Bill needed very little discussion. They should strongly impress on the Government of the day that, seeing the Bill was passed by such a large majority, they should now make it a first-class measure, and declare that they intended to carry it through during next session. If this Bill were played with for another session in the way it had been played with during the past one, it would make it clear that, although the Bill might pass its second reading by a large majority, the Government did not intend to make it law, but to dangle it before the eyes of the electors. Another question for discussion was as to whether the mines should be nationalized. He himself did not think that, if they were nationalized, the miners would be a penny better off than they were to-day. The question among miners was not as to whom the mines belonged to, but as to how the coal should be sold. With regard to the Employers' Liability Bill, nearly the whole of the collieries of the United Kingdom required a Bill which should secure compensation untrammelled by any contracting-out clause, or by any limitation whatever standing between the workman in suing for compensation for injury done to himself as a worker. The matter had been well fought out. Almost every section of labour had spoken out bravely, except a few miners and a few railway servants connected with permanent relief funds, and sick and accident funds. All he could say was that any employer of labour who desired to put his workmen into the position of part owners of his concern in one particular, should go the full length, and make them thoroughly responsible all round. As the Bill had been returned to the Upper House, he advised the conference to pass strong resolutions denouncing the Lords and upholding the Commons in their endeavour to make the measure worthy of its name.

IMPORTANT IMPROVEMENTS IN THE LEEDS WATER-WORKS.

The Water Committee of the Leeds Corporation have for some time past been considering the question of placing the city in such a position with reference to its water supply that, should there be at any time an accident to the main water-pipes, a full supply would still be available while the repairs to the main were being carried out. The matter has been made the subject of a report, which has been prepared by the Water Engineer (Mr. T. Hewson), and which was presented by him to the Committee at a meeting held last Friday week. In this document, he expressed his conviction that there ought to be in Leeds a system of six service reservoirs. There was, he said, already something of the kind; but it ought to be developed, until the collective capacity of the six reservoirs was equal to a two days' supply; for, in the absence of such provision, any accident to the water-mains that required more than two days to repair would result in the city being absolutely without water. The existing service reservoir on Woodhouse Moor had a capacity of 5,000,000 gallons, and those at Moortown, Bramley, and Wortley each held rather more than 1,000,000 gallons; so that collectively the present provision was only about 8,500,000 gallons, which was not equal to one day's supply—this at the present time being 13,500,000 gallons. Mr. Hewson also pointed out that these reservoirs served two other purposes. At night, when the mains were not being used to supply the inhabitants, they carried water to these reservoirs at the outskirts of the city; and in the morning, when the inhabitants began to draw on the mains, the water which had accumulated in the reservoirs during the night flowed back again towards the centre of the city. They were thus enabled to utilize pipes which otherwise would be performing no duty in the night, and to obtain during the day, by means of these reservoirs, a uniform pressure all over the city—a thing which would be impossible were the supply to be drawn simply from one source. In the latter case, the pressure, although the pipe might be running full with water, would become less and less as the distance increased, until at the remote end practically no useful pressure would be afforded. Mr. Hewson further explained that formal application had already been made to the Local Government Board; and that, after an inquiry, consent to borrow £30,000 for the first reservoir, which it was proposed to construct at Harehills, had been given. The reason that Harehills had been chosen was because of the rapid development of that part of the city, and of the fact that the existing supply in that district was, owing to the want of pressure, the poorest in the city. Before the work was begun, however, some details would have to be given to the Local Government Board. The reservoir would necessitate the purchase of six acres of land; and, when completed, its water dimensions would be about 80 yards square and 13 feet deep, which was equal to a capacity of 5,000,000 gallons. Two other reservoirs were also comprised in the general scheme of development of the works—one at Windy Hill, Hunslet, and the other at Beeston Hill. After these explanations, the Committee adopted the plans, and appointed a Sub-Committee to negotiate with the owners for the purchase of the necessary site at Harehills.

The Proposed Subways at Bolton.—At a recent meeting of the Streets Committee of the Bolton Corporation, the question of the proposed subways for gas and water mains and other purposes, already referred to in the JOURNAL, was considered. The Committee came to the conclusion that it was not desirable to take action in the matter at present.

ARTESIAN WELLS AS A SOURCE OF WATER SUPPLY.

At the last Meeting of the American Water-Works Association, held at Milwaukee (Wis.), a paper on the above subject was read by Professor E. G. SMITH. It appeared in a slightly condensed form in the *Engineering Record*, from which we make the following extracts:—

The term "artesian well" has, unhappily, become somewhat confusing. Strictly speaking, it should be applied only to such deep wells as are bored through impervious rock strata to a porous water-bearing rock stratum, whence the water flows to the surface, and is discharged from the bore. The study of artesian wells is legitimate and necessary for a hydraulic engineer, as at so many points are they under consideration as a source of water supply for public service. This study includes two quite separate and distinct fields—the purely geological and the purely chemical.

Dealing first with the essential geological conditions of artesian wells, they may be said to be the following: A porous stratum to receive and permit the passage of the water; an impervious stratum below, to prevent the escape of the water downwards; a similar impervious stratum above, to prevent the escape of the water from the bed upwards; an inclination of the strata, so that the edge where waters enter may be higher than at the surface of the well, and give the head; a suitable exposure of the edge, preferably with a covering of porous sand or gravel, to form a collecting area sufficient for the supply of water; an adequate rainfall, to furnish this supply; and an absence of any escape for the water at a lower level than the surface of the well. With regard to the chemical features of artesian well supply, the quality of a water is the gravest question for the consulting engineer to adjust in his determination respecting the best available local source for a public system. The term "pure water" is fast disappearing from the specifications of engineers and guarantees of franchises. Experience has taught us not to guarantee the impossible; and to supply a pure natural water is an impossibility. The confusion existing as to the quality of water from artesian wells arises from our imperfect knowledge of the strata whence the flow comes; and also from an attempt being made to compare waters from absolutely different strata, and therefore of probably radically different character. It is safe to assume, however, when water from one stratum has been proved to be good, that elsewhere we may expect the same quality of water, if only we are able to strike into the same stratum, and then to sufficiently protect that stratum from degrading infiltration.

It seems to me that we can make this matter very clear, if we follow one series of artesian wells somewhat in detail. The whole Mississippi basin furnishes us with the best examples of artesian service in America; and among the best-defined artesian wells of this basin are those springing from the Potsdam sandstone. This crops out in Wisconsin—its lower edge being around Portage, about 30 miles north of Madison, and running in an irregular crescent shape across the State. Its greatest width is about 50 miles; and the area covered is upwards of 12,000 square miles. This stratum then dips somewhat to the east of south; passing under Southern Wisconsin, and reaching to unknown distances south. This bed is upwards of 1000 feet in thickness. In texture it is a loose, porous sandstone, with thin beds of shale and limestone irregularly traversing it. The confining impervious stratum above is the magnesian limestone; the Potsdam resting directly upon the old archæan and granitic formations. The exposed edge of the Potsdam in Wisconsin is channelled and furrowed by watercourses, and is covered with a more or less thick layer of drift sand and gravel. The very ideals for an artesian service are thus realized. What is the quality of the water, and how may the data be used in studying other prospective supplies for this region above the Potsdam sandstone?

The source of the water supply is primarily the rainfall on the collecting area. This water, thus originally essentially pure, will contain such mineral salts in solution only as the waters may meet and traverse in their course downward through the superficial drift and the deep strata. I can fortunately offer for study nine full analyses of waters from the Potsdam sandstone, concerning the integrity of which I have absolutely no question as being true Potsdam waters, and efficiently cut off from infiltration from other strata. These wells are in an almost straight line north and south, and follow essentially the dip of the sandstone. All of these analyses, with the exception of the first one, were made by myself at different periods.

Locality.	Date.	Depth in Feet.	Total Solids. Grains per Gallon.
Madison (Wis.)	..	1015	30·76
Janesville (Wis.)	1887	..	26·75
Whitewater (Wis.)	1889	957	28·35
Burlington (Wis.)	1889	1008	26·01
Rockford (Ill.), Well No. 1	1885	1530	28·11
Do. Well No. 2	1886	1320	28·82
Do. Well No. 3	1886	1996	28·67
Dixon (Ill.)	1889	1600	28·39
Sterling (Ill.)	1886	1450	30·64

In addition to the above table, I can add the following data regarding these Potsdam waters when only partial analyses were made:—

Locality.	Date.	Depth in Feet.	Total Solids. Grains per Gallon.
Rockford (Ill.), Well No. 4	1891	1300	17·0
From five wells combined	1891	1530	..
" " "	..	1320	..
" " "	..	1996	19·3
" " "	1891	1300	20·0
" " "	1891	1379	20·0
Graham's Mill	1891	1400	17·8
Princeton (Ill.)	..	2500	23·7
Belvidere (Ill.)	..	1932	16·7

The second general principle regarding the waters from artesian wells can, I think, also be best understood by a special case; and for this purpose I will again take the Potsdam sandstone. It seems safe to assume that we may regard about 28 to 30 grains of solids, calculated as in above table, as the normal constitution of true Potsdam water. But other waters represented as coming from Potsdam sandstone give quite other results, of which I will cite a few typical cases from analyses collected from various miscellaneous sources, but not verified by the analyst or by check analyses:—

Locality.	Depth in Feet.	Total Solids. Grains per Gallon.	Alkalies, Sulphates Chlorides, and Carbonates.
Woodstock (Ill.)	1300	39·90	15·09
Monmouth (Ill.)	1227	73·80	42·62
Rock Island (Ill.)	1100	67·30	51·00
Davenport (Iowa)	2150	60·10	38·00
Clinton (Iowa)	1674	38·80	18·00
Kenosha (Wis.)	1365	36·02	12·30

Many others might be given—some of them with even greater differences than these; but what I wish to call special attention to is that the Potsdam water contains normally about 28 to 30 grains per gallon of solid matter, of which only about 1 to 2·5 grains are the soluble salts of the alkalies—*i.e.*, the sulphates, chlorides, and carbonates of potash and soda; leaving roughly about 26 grains of the other mineral matters, mostly the bicarbonates of lime and magnesia. In these cases cited, there is a marked increase in solids; but that is due to an increase of the soluble alkaline salts. The carbonates of lime and magnesia are usually somewhat diminished, being changed into the corresponding sulphate. To explain and account for these deviations, we are therefore forced to one of two conclusions—either the data furnished by some analyses are incorrect, or waters from some points of the Potsdam sandstone are subject to local variations.

The second perplexing proposition finds its answer, it seems to me from my study of these wells, in the fact that, while the water from the sandstone is true Potsdam, it has been materially altered by infiltration from the superincumbent strata which the drill has traversed, and the infiltrations from which have not been sufficiently cut off or plugged back.

There is one other very important feature regarding the constitution of deep artesian waters to which I would call attention—viz., the significance of a sanitary analysis of the water. This aims at giving such data as may lead to some accurate conclusions regarding the presence and amounts of organic matters in water, and the consequent healthfulness or unhealthfulness of a supply.

One unanswerable argument in favour of artesian wells hitherto advanced has been their positive freedom from organic and surface waters and sewage. The very conditions for an artesian well—deep, impervious, superimposed strata—seem to favour the idea. In the actual demonstrations to prove the presence or absence of organic matters, the methods of the sanitary analysis of surface waters have been widely applied. There may be no objection to this study of the waters; but I am sure we shall be led into serious error in formulating an opinion, unless extreme care is taken regarding the correct interpretations to be given to these analyses. I have made several whole or partial sanitary analyses of artesian waters, and have collected some made by others from these wells. They almost without exception fall into one of two classes. Those where the data are reduced to almost zero in each determination, and therefore show the absence of organic matters; and those where the analyses show some astounding amounts in one determination, notably in that of free ammonia. It is the second class to which I wish to allude, as the results obtained are very abnormal; and reports based on these data have been made regarding such wells, positively condemning them.

In a paper I read before the American Association for the Advancement of Science at Madison, on "The Occurrence and Distribution of Nitrogen in Deep Artesian Wells," I called attention to these peculiar conditions and phenomena; and I will introduce one table used at that discussion. The analyst or hydraulic engineer who may have had much experience with deep wells will have noticed the extraordinary amounts of free ammonia some of them show—in fact, so much that our ordinary methods of estimating it are almost worthless. But as significant is the fact that, while the free ammonia is so high, nitrogen in all other conditions, as albuminoid ammonia, nitrous acid, and nitric acid, is wanting This is quite contrary to what we should expect, or what we do find almost without exception, in surface waters. To make clearer this peculiar condition of the nitrogen, I will give ten such analyses of waters from the artesian wells, which are selected as well illustrating the phenomena.

Locality.	Depth in Feet.	Total Solids. Grains per Gallon.	Free Ammonia.	Albuminoid Ammonia.
Whitewater (Wis.)	315	16·7	0·15	0·01
Masillon (O.)	203	15·4	0·45	0·01
Chicago (Ill.)	400	13·6	0·26	0·07
Van Wert (O.)	53	93·5	0·52	0·03
Do.	98	93·9	0·59	0·02
La Grange (Ill.)	2100	31·6	0·40	0·05
Peru (Ill.)	1360	49·5	1·08	0·05
Hillsborough (Ill.)	400	39·1	1·20	0·01
Harvey (Ill.)	1300	88·0	0·90	0·00
Davenport (Iowa)	1067	73·2	0·90	0·01

The study of this table develops some noteworthy observations—viz, the enormous amounts of free ammonia; the trace of albuminoid ammonia so low as to suggest whether it really is not accidental or free ammonia, only expelled after the addition of the strong alkaline permanganate solution added to develop the albuminoid ammonia; the absence of nitrites and nitrates. The presence of any such amount of free ammonia in any similar surface water would be viewed with grave suspicion, if not positively condemned; and application of these

standards to artesian wells might lead to condemnation. It is to be specially noted, however, that we have the nitrogen all aggregated into the one form of ammonia, and not distributed through the four forms usually met with. I think this is remarkable; and it attracts attention. A simple calculation of the nitrogen changed into, and distributed through, these usual forms would show it to fall well within the accepted standards for maximum impurity of waters.

Regarding the gases present in these deep artesian wells, I would note the carbonic acid gas almost always present in the free state, and by virtue of which the carbonate of lime and magnesia are held in solution. Oxygen, according to Dr. Brown, the eminent Analyst, of Boston, is always absent in these deep wells. Sulphuretted hydrogen is very often present. It is, however, very elusive, and disappears rapidly and wholly on relief of the waters from pressure and on aëration.

In conclusion, to briefly sum up my observations on these artesian wells, I would note: (1) The distinctively geological study and the distinctively chemical study it is necessary to give the problem, in arriving at intelligent conclusions before advising on, or attempting to develop an artesian service for a public water supply. (2) The confusion and perplexity which exist on collocating and comparing results of analyses of waters from other artesian wells, and on attempting to intelligently and profitably use them. (3) The fact that waters from a given stratum are presumably of a practically uniform character. (4) That waters from such strata are materially altered by infiltrations from superincumbent or inferior strata. (5) In the application to the deep artesian wells of the method of sanitary analysis, as usually employed for classifying and properly valuing surface waters, care must be taken, in the interpretation of results, to arrive at correct views and knowledge regarding them. These five points have been definitely kept in mind during the preparation of this paper; not with the idea that they in any sense exhaust the study of the water supply from deep artesian wells, but with the hope that they may throw additional light upon one of the difficult problems of the engineer.

Haslingden Corporation and the Gas-Works.—The negotiations of the Haslingden Corporation for the acquisition of the undertaking of the Haslingden Union Gas Company appear to have failed. At a meeting of the Town Council held last Wednesday Mr. Barlow said they had offered the Company 24½ years' purchase of the average profits, or £80,000, which was £33,000 more than the capital of the Company, and upwards of £4300 in excess of the present marketable value of the shares. The Company, however, wanted to be guaranteed their maximum dividends in perpetuity, which would be equal to the Corporation having to invest £149,000 in Consols. No comment was made upon this statement; and it would therefore seem that the matter is at an end—at all events for the present.

Fatal Paraffin Lamp Accident.—The danger of leaving lighted paraffin lamps within the reach of children was illustrated in a lamentable way last week at North Shields. Mr. and Mrs. Pyner, of Beacon Street, were temporarily absent from their home on Sunday evening, and left their infant son in bed, with a lamp standing on a table close by. It is supposed that the child had wakened up; and finding himself alone, scrambled out of bed, and dragged the lamp over. When his cries brought assistance, it was found that the table cloth was ablaze, and the poor little fellow was burnt from head to foot. All efforts to relieve the little sufferer failed; and he died at an early hour on Monday morning. At the inquest, the Coroner very properly reprimanded the mother for her carelessness.

The Accident at the Blackfriars Electric Light Station.—Last Tuesday, the inquiry into the circumstances attending the death of Frederick William Ball, which occurred at the Blackfriars station of the London Electric Supply Corporation on the 12th of September last, as recorded in the JOURNAL at the time, was resumed before Mr. A. C. Langham, Deputy-Coroner for Southwark. The inquiry had been twice adjourned to allow of the attendance of Ernest Meech, who was injured by the electric current, and had since been in St. Thomas's Hospital. Meech now stated that on Sept. 12 he was at the station with Ball. It was Ball's duty to turn off the current about six o'clock each evening, and to obtain a fresh supply from Deptford. It was then witness's work, after the current had been switched off, to "clean down" the machines. On the night in question, he asked Ball, as usual, if it was safe to begin the work; and he received a reply in the affirmative. He began to dust down, and on coming to transformer No. 42 he caught the current between the thumb and finger of the left hand. He was standing on the ground at the time, and fell into the pit in an insensible condition. On recovering consciousness, he shook Ball; and, receiving no answer to his questions, he concluded he was dead. He then crawled to the door. He had been a fortnight in the employment of the Corporation, and had only been instructed in his duties by Ball. He quite understood that it was dangerous to go near the transformer when the plug was on. He could not account for Ball telling him it was safe. He did not wear boots; but Ball did. They had no gloves on at the time. The Coroner then read over the evidence, and said he thought they could come to no other conclusion than that Ball's death was due to an accident; but, in returning their verdict, he thought the jury might suggest a remedy which might prevent accidents in the future. He thought that india-rubber gloves might be worn with advantage. On the last occasion, Major Cardew had suggested to him that, when the current was on, the electric light should be fixed over the place where the contact was made—that was, at the uninsulated part of the "omnibus" bar—so that if the current was on it would be lighted by it, and would be seen by those at work. Major Cardew thought the glass globes ought to be coloured red; so that when the workmen went to dust they would at once see the light. He (the Coroner) regarded this as a very practical suggestion. The jury returned a verdict of "Accidental death," and added: "We are of opinion that had the men been provided with gloves the danger might have been averted. We also think that the rules and regulations at the station should be printed; and that the second man (Meech) should have been more competent before undertaking the work."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I think it is pretty well recognized that a Sheriff should be a man with a judicial mind; and if that be so, the quality should be exhibited off the bench as well as on it. Sheriff Jameson, of Perthshire, seems to me to scarcely fulfil this condition. On Thursday night, in proposing the toast of "The Magistrates and Town Council of Edinburgh" at a public banquet, he said "it appeared to him that of late years one of the great tendencies of town councils had been not to content themselves with governing the city, but also to become what one might call the contractors for the city business, thinking that it could be managed better by them than by private companies. In doing that, they were taking a very great burden upon themselves; and he further thought that it was, to say the least of it, more than doubtful whether they would succeed in managing these things so well as private companies. He would merely instance, in this connection, such things as the taking over of the rotten old Gas Company of Edinburgh, with its bad pipes and worn-out machinery, when they were on the very eve of having electric light introduced, and in meddling with the tramways. He could not help thinking that they would be better to leave such undertakings to private enterprise. Wherever a municipal government, or a government of any kind, left its ordinary functions and took up trade matters, it was likely to come to grief, because it could not devote the same time to the business, or look so strictly after its servants, as the private company did." Now, on the general principle, much may be said on both sides; and the Sheriff was certainly right in his view that corporations should not become contractors nor traders. But a Sheriff is bound to go upon evidence; and if he had taken the evidence of the one instance he cited, his dictum would have been the other way. It is only a month or two since Mr. Kinloch Anderson, at the Gas Commission, pointed out that since the Corporation took over the gas undertaking, in 1888, they had benefited the community to the extent of over £12,000 per annum. In the same way, since the Corporation took over the water supply, they have reduced the rates to, I should say, one-half what they were in the days of the Company.

Few places can show such a record of progressive advance in the matter of gas supply as the burgh of Hamilton has done since Mr. W. Ewing was appointed Manager of the gas-works there. In his report for December, Mr. Ewing gives comparisons with the working results in the same month of the three previous years. Dealing only with 1890 and 1893, the report shows that in the former year 1055 tons of coal, costing £669, yielded 8,430,000 cubic feet of gas, 170 tons of coke, and 35,369 gallons of tar and liquor; and that in December last 1066 tons of coal, costing £472, yielded 10,530,000 cubic feet of gas, 286 tons of coke, and 68,416 gallons of tar and liquor. The largest number of retorts in use in 1890 was 51; and in last December, 46. The maximum output of gas in December, 1890, was 320,000 cubic feet; and last December, 438,000 cubic feet. These results have been obtained though only half the number of retorts in use are of the new design. When they are all converted, there will be 77 retorts occupying the same space as 57 formerly did; and thus the productive power of the works will have been more than doubled, at a cost of £130, instead of the £12,000 or £14,000 the Commissioners were recommended to expend. And yet there are people in Hamilton who are dissatisfied, as was shown by speeches at the last municipal election.

The shareholders of the Falkirk Joint-Stock Gas Company met on Thursday, and approved of the Bill which the Directors are promoting in Parliament for the extension of their works. The Secretary read a minute of a meeting of shareholders, held two years ago, authorizing the Directors to apply to Parliament, which disposes of the complaint by some members of the Town Council that the subject was sprung upon them by the Gas Company. It is reported that the shareholders expressed confidence in the ability of the Directors to look after their interests, either in contesting the measure with the Town Council, or in adjusting any agreement with them. Of the latter, there is, as yet, no appearance; but now that the Directors have had their hands strengthened by the approval of the shareholders, they may take up the subject and be prepared to entertain any offer by the Committee of the Town Council. Of course, they will not themselves make any proposal, as they are not in the position of willing sellers.

Bailie Macpherson was the principal speaker at the annual social gathering of the Edinburgh city lamplighters, on Wednesday night. He gave the interesting information that, whereas in 1870 the number of public lamps in the city was 6459, there were now 10,044. The increase is due to the expansion of the city to a large extent; but it is also partly to be accounted for by the greater amount of light which is required by communities. The speaker also mentioned that during the recent severe frost 890 public lamps were frozen. The lamplighters, he thought, had a grievance in being required to turn out at midnight to extinguish one-third of the lamps. To allow those lamps to burn till sunrise would cost an additional £1600 a year; and he thought the Lighting Committee should consider whether they ought not to remove the grievance of the lamplighters—the city having the compensating advantage of better lighting and more security to property. It is strange how opinions differ. It is not so many years since the practice of extinguishing some of the lamps at midnight was begun; and it was then advocated by public men on the ground that it was a sheer waste of money to keep all the gas-lamps blazing the whole night.

A battle is raging in Stirling just now over the introduction of the electric light. The gas supply of the town is in the hands of a Company, between whom and the Corporation there has not, for some years at least, been much good-will—why, I cannot say, because gas is, considering the size of the town, as cheap as can be expected. It has been several times proposed to take over the undertaking of the Company; but the Town Council have never been able to do anything in the matter. Now they are having electric light thrust upon them from another quarter. The promoters of this movement are the Caledonian Electric Supply Company—an Edinburgh company, who incorporated themselves last June. The Company lost no time in getting to work, for in the same month they intimated to the Stirling

Town Council that they intended to apply to the Board of Trade for a Licence to supply the light in the burgh. Of course, the Council required some time to consider the matter; and then, in November, before they had made up their minds, the Caledonian Company lodged another notice, in which they changed their application from a Licence into a Provisional Order. This had the effect of waking up the Town Council; and they, in haste, called in Mr. W. Arnot, C.E., the Electrical Engineer of the Glasgow Corporation, to advise them. Mr. Arnot's report was strongly in favour of the Corporation themselves applying for a Provisional Order. The Town Council, sitting in Committee on the 26th ult., resolved upon this policy. Then up rose someone in the community; and, without much agitation, a requisition to the Town Council asking them to rescind their resolution, and to allow the Caledonian Company to get their Provisional Order, was hawked about the town. In no time, as many as 400 names were got to this document; and a very influential deputation presented it to the Council on the 8th inst. The most striking feature of the discussion that ensued was that everyone was equally in favour of the introduction of the new light. Another point, and one which is creditable to the Councillors, was that reference was made to the Gas Company only twice—once in regard to the great profits they earn, and again when a speaker told the Council that electricity at 6d. per unit, which is the price proposed to be charged, would be dearer than gas. Regarding this latter remark, I wish to say a word, because a local newspaper Solon, in an editorial, called it in question, putting the case in this way: "Mr. Govan stated that electric light at 6d. per unit was higher in price than gas. Six units, which are equivalent to 1000 cubic feet of gas, cost 3s.; 1000 cubic feet of gas in Stirling costs 3s. 7d. Mr. Govan might explain his meaning." Mr. Govan may explain his meaning if he likes; but, so far as the community of Stirling may be reached by these "Notes," I consider it my duty to point out to them that it is twelve units of electricity, and not six, which are recognized as equivalent to 1000 cubic feet of gas. That would make electricity 6s., as against gas at 3s. 7d., which fully bears out Mr. Govan. But that is not all, because the twelve-unit equivalent is with 16-candle gas, whereas in Stirling the gas is nearly double that power; and so it is safe to say electricity in Stirling would cost not less than 9s., as compared with gas at 3s. 7d. The community of Stirling do not seem to be critical in this direction. As I said above, the whole Council favour electric lighting, which makes me suspicious that it is not so much electric lighting that they want, as to have a handle against the Gas Company; and that, whenever they may get a Provisional Order, another attempt will be made to acquire the Company's undertaking. The Council wrestled long with the subject on the 8th inst.; and at last, by the casting vote of the Chairman, they resolved to withhold their consent to the application by the Caledonian Company. The battle is over who is to supply the light, not whether it should be introduced. That seems never to have been discussed, and one would think it should be the first question.

Aberdeen has produced a genius in the person of Bailie M'Kenzie. The Corporation are about to inaugurate an installation of electric lighting; and they propose to light several of the leading thoroughfares with the new light. I have before mentioned as foolish their intention, on account of the cost, to extinguish the street arc lamps at midnight, and to light the gas-lamps. Apparently, the absurdity of the intention has dawned upon Bailie M'Kenzie; but his proposed method of getting out of the difficulty is as absurd, if not more so. It is to place an incandescent electric lamp upon each lamp-pillar; and when the arc lamps are put out, to light them up. He expects the same cable to serve both series of lamps; but how, I cannot see. Perhaps I am not sufficiently versed in the wonders of electricity; but I must say that, with my present knowledge, I cannot imagine how a circuit can be controlled so as to light only certain lamps at one time, and then, at a given signal, to extinguish these and light up another set. I hope the reporter who announces his proposal to-day has misunderstood him on the subject of the same cable. Apart from that, however, the proposal does not commend itself. If I mistake not, incandescent lamps have been tried for street lighting, and have not given satisfaction. Professor Kennedy is the adviser of the Corporation. Has he been consulted in the matter? and if he has, how is it that he has not informed Bailie M'Kenzie of the famous turning down arc lamp which Mr. M'Kenzie, of the Edinburgh Corporation, spoke of the other week? Could anything show more clearly how much electric light votaries are, in reality, groping in the dark? The Corporation expect to be able to turn on the electric current about Feb. 19. Can anyone explain how it is that these public installations are always turned on at the fag-end of the lighting season? It looks very like as if it were arranged so that customers should not be alarmed by the big bills they would run up were they to have to pay for a whole season's lighting.

In our correspondent's "Notes" in the JOURNAL for the 2nd inst., reference was made to a question raised by Mr. H. W. Hunter, at a meeting of the Edinburgh and Leith Gas Commissioners, as to the distribution of the contracts for gas-meters. Mr. Hunter's attention has been called to the remarks of our correspondent, who regarded the question as a "trifling" one; and he writes thereon as follows: "I fear your correspondent, like some of the Gas Commissioners, has not fully understood my intention. All that I contended for was simply this—that, as the Gas Commissioners had agreed that all orders for gas-meters should be equally divided among the makers in this city, it was our duty, as Gas Commissioners, to see that this was done as nearly as possible. When I asked for this return before, I found that one maker had an account of only £50, while another had one of nearly £600; and I wished to guard against this being repeated. It may have appeared a trifling matter to your correspondent; but I felt it a duty belonging to the Commissioners to see that the orders were divided as equally and fairly as possible, and not to leave it to their employees."

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 20.

Sulphate of Ammonia.—The firmer tone is well sustained; and nearly all parcels offering have been readily taken off the market. The consumptive demand is improving; and Continental and Colonial inquiries have been more noticeable than for some time past. The production, no doubt owing to the exceptional weather, shows already a falling off; and, as the shipments to date are much heavier than last year, this anomalous state of things must have its effect upon prices before very long. Quotations meanwhile are sensibly higher; £13 12s. 6d. being quoted at the close. Nitrate, on the other hand, is easier, and can again be bought at 9s. 3d. *ex* ship.

LONDON, *Jan.* 20.

Tar Products.—Pitch is firm for prompt delivery; but, for forward contracts, buyers will not pay anything like to-day's quotation. With a falling coal market, pitch is certain to see lower prices. The benzol market is demoralized by the continuous advent of fresh supplies from German metallurgical works. There is no doubt that market operators circulate these rumours with a view to depress values; and, while allowing for some exaggeration, there is without doubt a continually larger quantity of benzols coming into the market from these sources. Benzols, 90's, have been done at 1s. 4½d., less 3½ per cent.; while 50's are valued at 1d. more, though very little business is being done in either quality. Creosote and common tar oils are decidedly firmer; makers being remarkably free from stocks, having regard to the period of the year. Anthracene is strong; the Committee's price being recognized as the value for best qualities. Sales of second-rate and low-class anthracene have been reported at 10d. to 10½d. per unit, which looks as if the price fixed by the Committee for their qualities is a reasonable one. Business during the week has been marked at the following rates: Tar, 15s. to 17s. Pitch, prompt, 29s.; forward, 27s. Benzol, 90's, 1s. 4½d.; 50's, 1s. 5½d. Creosote, 1⅞d. Creosote salts, 25s. Solvent naphtha, 1s. 3d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 7⅞d. Carbolic acid, 60's, 1s. 8d.; crystals, 6d. Cresol, 1s. 4d. Anthracene, 30 per cent., "A," 1s. 2d.; "B," 10d.

Sulphate of Ammonia.—This market shows great strength; the demand is brisk, and for prompt business £13 15s. is obtainable; while makers value spring delivery at 14s., in both cases less 3½ per cent., delivered free on board, bags included. Gas liquor is quoted at 8s. to 9s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Although, for the most part, prices throughout the coal trade of Lancashire continue steady at late rates, the position is scarcely so strong as it has been; and the market would seem to be on the point of wavering towards some downward movement. This certainly is the view taken by most of the large buyers; and not only is there a good deal of pressure for lower quotations, but orders of any weight are just now being held back in anticipation that, by waiting, more favourable rates can be secured. The return of exceptionally mild weather has, of course, helped to weaken the market, by lessening the pressure for house-fire consumption; and collieries are in most cases gradually clearing off their arrears of orders. There is no quotable reduction upon list prices; but it is exceptional where more than 14s. to 14s. 6d. is being got for best Wigan Arley. Pemberton four-feet and second qualities of Arley do not average more than 12s. 6d. to 13s.; and common house coals, 11s. 6d. to 12s. per ton at the pit mouth. The lower qualities of round coal are in fairly good demand, for steam and forge purposes; and there are no surplus supplies on the market. At the pit mouth, steam and forge coals average 10s. to 10s. 6d. per ton, for inland sales; and for shipment, they realize from 11s. 6d. to 12s. 6d. per ton, though a meeting of colliery representatives in Liverpool held last week decided that 12s. should be the minimum figure for delivery at the ports on the Mersey. Engine classes of fuel are fairly plentiful, and are offered at lower prices from outside districts, with the result that they are competing with Lancashire supplies in some of the local markets. For Lancashire burgy, prices average 8s. to 8s. 6d.; but the better descriptions of slack average 6s. to 6s. 6d., with common sorts at 5s. to 5s. 6d. per ton at the pit mouth. Although there are a good many reports as to contracts being placed in other districts for next year's supplies, very little so far has been done in Lancashire; and these are evidently being held back until it is seen how prices are likely to turn when the pressure for winter demand is over. The fact that prices in Yorkshire are not being so well maintained—concessions of one sort or another being already made in a good many cases—also has its effect upon the market.

Northern Coal Trade.—With a fuller output of coal, and with some slight diminution in the local sales to outside places, there is now an ample supply of fuel, so that the deliveries on contract have been enormous. The tendency in prices has been lower on the whole, though the fall is very slow in comparison with that which had been expected. There is perhaps the greatest strength on the part of steam coals, for which the demand is very large for the season. Best Northumbrian steam coals are now about 12s. 6d. per ton f.o.b.; but 6d. per ton more has had to be paid to one colliery, to secure delivery at the end of the month. Second-class steam coals are about 1s. per ton below best steam; and small steam coals are very dull. The price is from 4s. to 4s. 3d. per ton. Gas coals are being much more freely delivered on contract. The demand from the Midlands having now practically ceased, there is a full supply for the ordinary customers of the district. The shipments to the Metropolis have been very heavy, the great gas companies apparently desiring to replenish their stock of coal. Prices of gas coal are now rather easier; but they vary with different collieries, according to the position and to the state of the contract-book. About 9s. per ton f.o.b. may be looked on as the more general quotation for best Durham gas coals; but while there are collieries that will take less, there are others that ask as high as 10s. 9d. per ton. Manufacturing coal is plentiful; and the contracts that have

not yet been placed are being offered at a slightly lower price than was asked a month ago. Coke is rather steadier, there being a better local demand, though the shipments are still rather limited. For best Durham coke for export, 15s. 6d. per ton f.o.b. is still the price. Gas coke for manufacturing purposes commands about 1s. per ton higher than for the past year; but there is no change in the prices for the local domestic consumption. The stocks of the local makers of gas coke are still rather limited.

Scotch Coal Trade.—Good trade is being done in coal in Scotland, due to the fact that there is a great deal of stocking going on; many manufacturers being apprehensive of higher rates next month, though there do not as yet appear any signs of such happening. In some places delegates are urging the miners to adopt a restrictive policy; but the disposition of the men seems to be rather against such a course. At all events, they are not actively supporting the delegates. Another reason for believing that little or no trouble need be expected from the men, is that in cases where the 1s. per day granted at the time of the late strike has been taken off, the men have continued to work without comment. There is little forward business being done, except for ell, for which a considerable foreign demand is arising. Steam, splint, and main are in good demand. There are very full supplies; and consequently prices are with difficulty maintained at what they were last week, with the exception of splint. A Glasgow newspaper announces that second and third class gas coal is in active demand; that purchases the latter part of last year were slack, and that they are now coming in, with the result that prices are at present from 2s. 6d. to 3s. per ton higher than the lowest point they reached last year. The writer of the article expects there will be an advance upon December prices. His information is not, however, of much consequence in the meantime. Quotations are: Main, 9s. 3d.; ell, 10s.; splint, 9s. 6d. to 9s. 9d.; and steam, 11s. per ton f.o.b. Glasgow. The shipments have been well maintained, having amounted to 128,132 tons—an increase of 36,190 tons upon the preceding week, and of 29,411 tons upon the corresponding week of last year. For the year to date, there has been a total of 220,076 tons—an increase upon the same period of last year of 61,174 tons.

An Extraordinary Accident to a Gas-Lamp.—On Sunday evening last week, an explosion of gas occurred in a gas-lamp at Seaforth. A considerable portion of the surrounding pavement was torn up and scattered in all directions; and the lamp itself was damaged. Fortunately no personal injury was sustained. It is believed the explosion was the result of the action of the recent frost upon the meter.

An Explosion of Gas Caused by a Steam-Roller.—On Monday last week, a somewhat serious explosion of gas occurred at South Bank. For some days past, a strong smell of gas had been noticed in several of the houses in Nelson and Clarendon Streets; and information of this having been given at the gas-works, the Manager (Mr. W. Nixon) caused a search to be made for the leakage. A large hole was dug in Nelson Street; and, on a light being applied, the explosion took place—resulting in a large portion, nearly fifty yards, of the flags on each side of the footpaths in Clarendon Street being lifted out of position. It is supposed that the fracture in the main pipe was produced by a large steam-roller which had been at work; and every precaution is now being taken to prevent any further mishap.

The Quality of the Gas at Leeds.—At a meeting of the New Wortley Sub-section of the Gas Committee of the Leeds Corporation held yesterday week, the question of the purity of the gas was considered. The Manager of the New Wortley works presented a report dealing with the causes of the deficiency in illuminating power; and his explanation was accepted. Nevertheless, the Committee expressed the opinion that the gas should not fall below 18-candle power, which was the standard recently fixed by the Corporation. In connection with this matter, they discussed the desirability of adding to the purifying plant at New Wortley. Half the gas supply for the city is manufactured there; yet the purifying space is only 26,000 feet compared with 48,000 feet at the Meadow Lane and York Street works. The Gas Committee and the Council will therefore be asked to sanction the provision of supplementary plant. A deputation has since been appointed to visit the Manchester Gas-Works, for the purpose of examining the overhead purifiers in use there.

Damages for an Accident at the Crystal Palace Gas-Works.—At the Westminster County Court, on Monday last week, his Honour Judge Lumley Smith, Q.C., and a jury had before them the case of *King v. Ashmore*, which was an action brought under the Employers' Liability Act by John King, a riveter, of Lower Sydenham, to recover damages from Messrs. Ashmore, Benson, Pease, and Co., Limited, for personal injuries which he alleged he sustained while in their employ, through a defect in their plant or machinery. Mr. W. M. Thompson appeared for the plaintiff; Mr. Moyses and Mr. Dobb represented the defendants. It was stated that on Aug. 5 last plaintiff was working at a new roof on a retort-house at the Crystal Palace District Gas Company's works. The framework of the roof was resting on the brick gables of the house. It was of metal, weighing many tons, and was held in position by two wire ropes attached to crabs or windlasses. To allow plaintiff to go on with his riveting, the framework had to be shifted about an inch. A man tried to turn the crab; but he could not move it, and was going to loosen the one on the other side. He had not gone three paces, however, when the rope snapped. The 40 or 50 tons of roof swayed and fell with plaintiff on top of it for about 50 feet. Plaintiff had only time to call out to the men below. He then tried to make good his own escape, but was too late. He had been unable to do any work since the accident; and he was at the time earning 30s. weekly. Dr. Taylor said the plaintiff suffered from a diseased hip through the accident, and would never again be the same man that he was. Plaintiff's witnesses alleged that the rope which broke was perished and rotten. The defence was that there was no negligence on the part of the defendants. The man who gave the orders and the man who obeyed them had no authority. A blunder was made in straining one rope, and thereby putting the full strain on the other. The jury, after being directed by his Honour as to the law, returned a verdict for the plaintiff for two years' wages—£156; and his Honour gave judgment with costs.

The Agitation for Cheaper Gas in London.—Last Thursday, a public meeting of the inhabitants of the Notting Hill and North Kensington districts was held at the Congregational School Room, Basing Road, to protest against the charges of The Gaslight and Coke Company to consumers on the north side of the Thames, as compared with those made by the same Company on the south side. Mr. F. C. Frye, M.P., presided; and he was supported by Mr. J. Rowlands, M.P., and others. The Chairman, in opening the proceedings, said they had met to protest against the practice of the Company in charging 8d. per 1000 cubic feet more on the north than they did on the south side of the river; and he was surprised that the consumers had been patient so long under the injustice. As one who paid last year about £1200 for gas, the matter was a serious one to him personally; and while he did not wish to have the wages of those who toiled in any way decreased, he could not see why there should be such a difference—the only apparent reason being that on the south side there were competing Companies. Where the gas was, as it should be, in municipal hands, as at Nottingham and Manchester, they were much better off; and it was time that Londoners agitated in this direction. Mr. Rowlands, M.P., having explained the origin of the agitation which commenced in the parish of St. Luke's, moved—"That this meeting of gas consumers supplied by The Gaslight and Coke Company protests against the high charge of that Company for gas, compared with other Companies; and this meeting is of opinion that a Parliamentary Committee should be appointed to inquire into the present condition of the gas supply of London, with a view to legislation in the direction of securing a reduced and uniform rate of charge, the free use of meters, and a further diminution in the statutory rate of dividends." He said he was in favour of the municipalization of the supply; but they had to see how far the electric light was going before they talked about purchasing the goodwill of the Companies. He contended that the conditions affecting the three great Companies were the same; and he showed how, in spite of the fact that The Gaslight and Coke Company had more than doubled the number of consumers and miles of mains, as compared with the other Companies, they charged more than a small Company like the Commercial, who had recently made a reduction of 2d. per 1000 cubic feet. Mr. W. A. Cubitt seconded the motion, which was carried; it being further resolved that a copy should be forwarded to the President of the Board of Trade.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 146.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk	Yield upon Investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	17—18	+½	5 16 8
100,000	10	,,	7½	Do. 7 p.c.	10	11¼—12¼	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	+1	4 13 4
100,000	20	14 Dec.	8	Bahia, Limited	20	10½—11¼	+½	13 18 3
200,000	5	15 Nov.	6¼	Bombay, Limited	5	4¾—5¼	..	6 3 10
40,000	5	,,	6¼	Do. New	4	3⅜—4	..	6 10 0
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	220—225	..	5 2 2
180,000	,,	,,	8½	Do. New	100	163—168	..	5 1 2
220,000	20	15 Sept	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102—105	..	4 15 3
320,000	20	29 Sept.	11½	British	20	43—45	..	5 0 0
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	6—7	..	2 17 2
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	13 July	8	Cagliari, Limited	20	27—28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	245—250	..	5 0 0
165,000	,,	,,	9½	Do. New do.	100	188—193	+1	4 18 5
160,762	,,	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	228—233	..	5 11 6
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	198—203	+3	4 18 6
535,000	Stck.	15 Sept.	5	Crystal Palace Ord. 5 p.c. Stk	100	100—105	..	4 15 3
486,090	10	28 July	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15—16	..	4 13 9
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	234—239	+2	5 0 5
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	97—102	..	5 18 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	275—280	..	5 11 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	125—135	..	5 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	193—195	+3	5 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	173—178	..	5 18 7
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	270—275	..	5 12 9
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	5 10 7
1,061,150	,,	4 Dec.	4	Do. 4 p. c. Deb. Stk	100	127—130	..	6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130—135	..	6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	6 8 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	207—212	+1	5 13 2
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd	5	4½—5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	107—109	+1	4 11 9
541,920	20	15 Nov.	5	Monte Video, Limited	20	12¾—13¾	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6¾—7	..	5 14 3
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4¼	..	7 15 6
166,870	10	—	2	Pará Limited	10	1¾—2¼	+¼	—
420,000	100	2 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	98—102	..	5 17 8
500,000	100	1 Dec.	6	2nd Do.	100	96—100	..	6 0 0
150,000	10	13 Oct.	5	San Paulo, Limited	10	8¾—9¼	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	310—315	+3	4 18 1
1,350,000	,,	,,	12	Do. B do.	100	245—250	+1	4 16 0
260,000	,,	,,	13	Do. C do.	100	253—258	..	5 0 9
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	150—153*	+1½	3 5 4
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 9
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	268—273	+1	3 13 3
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	213—217	+2	3 13 9
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	143—148	..	3 0 9
700,000	50	14 Dec.	8½	Grand Junction	50	113—117	+3⅜	3 12 8
708,000	Stck.	16 Aug.	11	Kent	100	288—293	+1	3 15 1
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	245—250	+8	3 16 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	197—202	+1	3 14 3
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 6
500,000	100	16 Aug.	12½	New River, New Shares	100	365—370	+7½	3 5 6
1,000,000	Stck	28 July	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V xnall, 10p. c. max.	100	156—161	+1	3 14 7
126,500	100	,,	6	Do. D 7½ p. c. do.	100	145—150	+1½	6 0 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	265—270	+2½	4 14 1

*Ex div.

Sales of Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. A. Richards disposed by auction of the following gas and water stocks and shares: £360 of "A" stock of the *Tottenham and Edmonton Gas Company*, the last dividend on which was 11½ per cent. per annum, at the rate of £230 per cent.; £270 "B" stock in the same Company, the last dividend on which was 8½ per cent., at £165 and £170 per cent. In the *Enfield Gas Company*, nine £10 fully-paid ordinary shares, the interim dividend to the 30th of June last being at the rate of 6 per cent. per annum, were disposed of at £14 15s. each. Twenty £10 paid-up "D" (Water) shares in the *Barnet District Gas and Water Company* sold at £14 5s. each; and 34 similar shares, £8 paid up, realized £11 15s. and £12 each. Seventy fully-paid £10 shares, the last dividend on which was 5 per cent., in the *West Ham Gas Company* brought £12 10s. each; 47 similar shares in the *Ascot District Gas Company*, the last dividend on which was 2 per cent., £6 each, and 87 fully-paid £5 in the *Woking District Gas Company*, £4 and £4 2s. 6d. each. The remainder comprised £100 ordinary stock of the *Worthing Gas Company*, the last dividend being at the rate of 10 per cent., which sold for £187 10s.; and 19 fully-paid £10 shares in the same Company, the last dividend being at the rate of 7 per cent., which sold at £14 2s. 6d. each.——Last Thursday, Messrs. Alexander, Daniel, Selfe, and Co., of Bristol, submitted for auction £20,000 of 7 per cent. maximum ordinary stock in the *Bristol Water-Works Company*. The reserve price was £136 for every £100 stock; and the first lot realized £137 10s. A number of lots were disposed of for £137 5s. and £137; and towards the close some reached £137 2s. 6d. The whole of the stock was sold in about half an hour; the total sum produced being £27,404.

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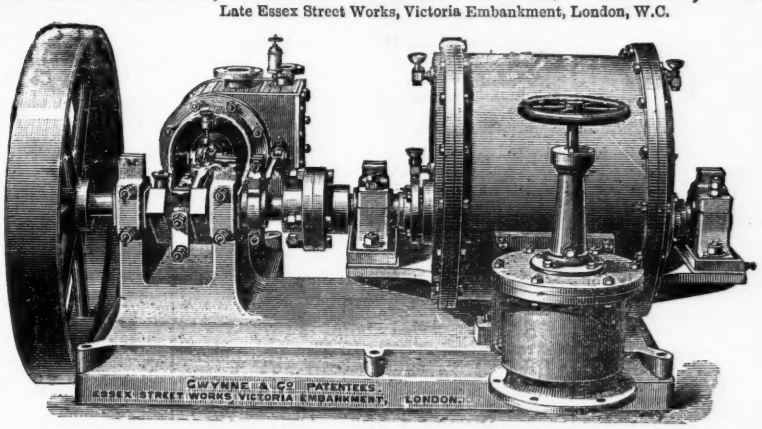

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Jan. 8, 1894.

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Specifications on application to
H. WILKINSON, Secretary.

Gas Offices, Harrogate,
Jan. 22, 1894.

ROUND Station Meter, by Porter and Co. of Lincoln, FOR SALE (3-inch Inlet). Cheap.

Apply SHIPYARD, RUTHERGLEN, N.B.

COMPLETE Gas Plant for Sale, com- prising three Iron Retorts (6 feet long), Condenser, Scrubbers, Purifier, and Gasholder, together with all necessary Connections and Valves. Suitable for Experimental Works.

For further particulars, apply to W. W. HULSE, Gas-Works, Longton, STAFFS.

STENCIL PLATES.

TO ENGINEERS AND ALL WHO DRAW PLANS.

TO BE SOLD, a magnificently executed Set for LETTERING PLANS, &c. The Set consists of TEN COMPLETE SETS of ALPHABETS, plain, shaded, and ornamental; FOUR SETS of FIGURES in various Styles; and FIFTY PLATES of all the principal words used upon Engineering Drawings, including Scales, Points, Corners, &c., in a mahogany case, with Brushes. Price for the whole, 30s.

Apply to Mr. G. BAKER, 22, Orpingley Road, Hornsey Road, LONDON, N.

BOROUGH OF WIDNES.

THE Widnes Corporation are prepared to receive TENDERS for the supply of FIRE-CLAY CLAY RETORTS, BLOCKS, and BRICKS.

Specifications and Forms of Tender may be obtained from Mr. Isaac Carr, Assoc.M.Inst.C.E., Gas-Works, Widnes.

Tenders, endorsed "Fire-Clay Goods," to be addressed to the Chairman of the Gas Committee, and delivered to the undersigned, not later than the 3rd of February prox.

The Corporation do not bind themselves to accept the lowest or any tender.

H. S. OPPENHEIM, Town Clerk.

Town Hall, Widnes,
Jan. 17, 1894.

RAMSGATE CORPORATION.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for about 53,000 FIRE-BRICKS, (various sizes and shapes), and 10 tons of CLAY.

Tenders to be sent in on or before Ten a.m., on Monday, Feb. 12, 1894, addressed to the Chairman of the Gas and Water Accounts Committee, Hardres Street, Ramsgate, endorsed "Tender for Fire-Clay Goods."

Specification and full Particulars on application to
WILLIAM A. VALON, Engineer.

TAR AND AMMONIACAL LIQUOR.

THE Rhyl Improvement Commissioners invite TENDERS for the purchase of the surplus TAR AND AMMONIACAL LIQUOR produced at their Works during the Twelve Months ending the 31st of January, 1895.

Tenders, stating price per ton, and endorsed "Tenders for Tar and Liquor," to be delivered to the undersigned not later than the 1st prox.

Particulars of quantities made, &c., may be had from Mr. Leonard G. Hall, Gas-Works Manager.

ARTHUR ROWLANDS,
Clerk to the Commissioners.

Town Hall, Rhyl,
Jan. 17, 1894.

SHEFFIELD UNITED GASLIGHT COMPANY.

EFFINGHAM STREET STATION.

TO IRONFOUNDERS, ETC.

THE Directors of this Company invite TENDERS for the supply of RETORT FITTINGS, including Hydraulic Mains, Ascension-Pipes, Buck-Staves, Floor Plates, &c., for 80 Mouthpieces.

Drawings may be seen and Bill of Quantities, with Form of Tender obtained, upon application to the Engineer, Mr. Fletcher W. Stevenson.

Sealed tenders must be delivered by post, addressed to the undersigned not later than Saturday, Feb. 3, endorsed "Tender for Retort-Fittings."

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Jan. 19, 1894.

PONTYPRIDD LOCAL BOARD (GAS).

TO GASHOLDER MAKERS.

THE Pontypridd Local Board invite TENDERS for the construction and erection of a TELESCOPIC GASHOLDER.

The Specification and Drawings may be seen on application to the undersigned; and at the Office of Mr. Thomas Newbigging, C.E., 5, Norfolk Street, Manchester. Quantities and Form of Tender may be obtained from the latter on deposit of three guineas, which will be returned on a *bond-fide* tender being received.

Tenders, endorsed "Gasholder, Contract No. 2," to be sent so as to reach me before Noon, on Saturday, the 3rd day of February, 1894.

The Board do not bind themselves to accept the lowest or any tender.

By order,
HENRY LL. GROVER, Clerk.

Local Board Gas Offices, Pontypridd,
Jan. 17, 1894.

SOUTHEND-ON-SEA.

MR. W. V. WILLSON is instructed by the Directors of the Southend Gas Company to SELL by AUCTION, at the Institute, Clarence Road, Southend, on Saturday, Feb. 3, 1894, at Three precisely, in 84 Lots, 400 NEW ORDINARY £10 SHARES (paying a Maximum Dividend of 7 per cent.) in the Southend Gas Company.

Particulars, with Conditions of Sale, may be obtained of Mr. J. T. RANDALL, Secretary, York Chambers, SOUTHEND; and of the AUCTIONEER, SOUTHEND.

SALE OF SHARES IN THE RYDE GASLIGHT COMPANY.

ON THURSDAY, FEB. 1, 1894.

MESSRS. E. MARVIN AND SONS are favoured with instructions from the Executors of the Will of the late Mrs. L. F. Maynard, to submit for SALE BY AUCTION, at Yelf's Hotel, Ryde, on the above date, at Four o'clock in the afternoon, in lots, 293 SHARES in the RYDE GASLIGHT COMPANY.

Particulars and Conditions of Sale may be had of the AUCTIONEERS, at their Auction and Estate Agency Offices, 76, Union Street, Ryde; at the place of Sale, as above; at the Offices of *The Estates Gazette*, 6, St. Bride Street, LONDON, E.C.; at the ROYAL PIER HOTEL, RYDE; the principal Hotels in the Island; and of the VENDORS' SOLICITOR (C. G. Vincent), 4, St. Thomas Street, RYDE, Isle of Wight.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

Coal Owners, Newcastle-on-Tyne;

or

E. FOSTER & CO.,

21, John Street, Adelphi, London, W.C.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.

For particulars, price, &c., apply to Mr. E. Price, Inventor and Patentee, 22, Alwyne Road, Canonbury, London, N.

Prices are Reduced.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

Note.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

JAMES WHITE & CO., Ltd.,

WIDNES, LANCASHIRE,

Manufacturers of Special

FIRE-BRICKS, FIRE-CLAY, & FURNACE CEMENT.

For GAS FURNACES our Gannister and Silica FIRE-BRICKS are acknowledged to be the best and most durable in the Market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest Quality.

FURNACE CEMENT specially made for repairing Furnaces and stopping Cracks.

Analysis and References on Application.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

THORNLEY GAS COALS

Worked by the

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

Tudhoe and Sunderland Bridge Gas Company.

Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

Gentlemen,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. Cowan,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

Telegraphic Address: "ROBUSTNESS, LONDON." EXCHANGE TELEPHONE 1756.

GASEOUS FIRING

FOR LARGE OR SMALL

RETORT-SETTINGS

PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED.

SPECIALTIES

J. & H. ROBUS,

20, BUCKLERSBURY, LONDON, E.C.

ENGINEERS & CONTRACTORS

FOR THE ERECTION OF GAS AND WATER WORKS COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.

B Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER PORT GLASGOW."

Established 1872.

G. WALLER & Co.'S NEW PATENT GAS EXHAUSTER

MADE WITH FOUR BLADES,

To pass 300,000 Cubic Feet per Hour, with or without Engine combined.

IN USE AND ON ORDER FOR OVER 100 WORKS,

AND EQUAL TO

5,340,000 CUBIC FEET PER HOUR.

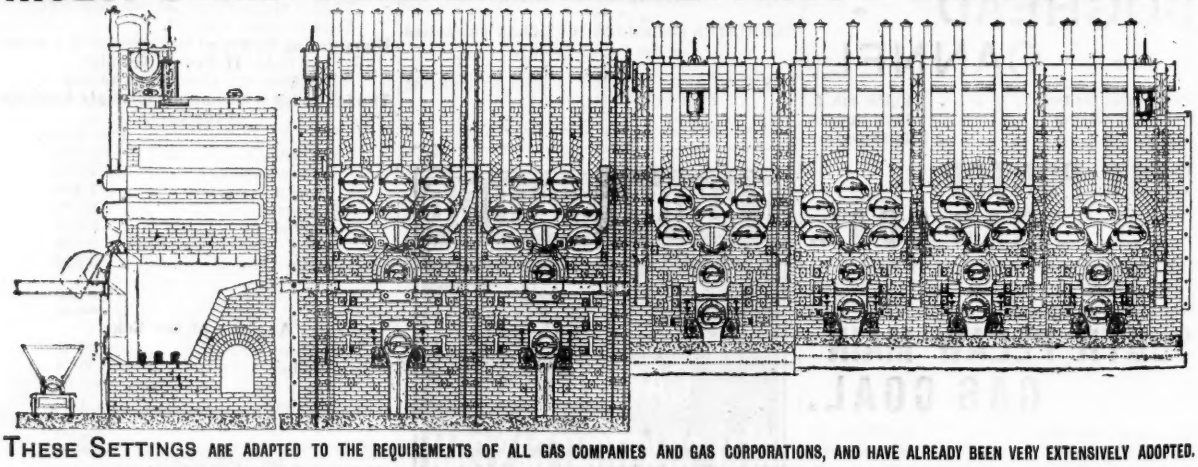
SPECIAL ADVANTAGES:—

The Four-Blade Exhauster **PASSES 60 PER CENT. MORE PER REVOLUTION** than any One or Two Blade Exhauster.
It takes 27 per cent. less power than any Two-Blade Exhauster.
It gives a **STEADIER GAUGE** than any other Exhauster.
One of our 150,000 feet per hour Patent Four-Blade Exhausters passes continuously **180,000** cubic feet per hour, driven by a **12-INCH STEAM CYLINDER.** No other Maker can give a similar result.
Model of Patent Exhauster sent for inspection.
Oldest Makers of **BEALE EXHAUSTERS** for over 300 Works.
Patent Compensating Steam Governor, Special Tar and Liquor Pumps, Gas-Valves.
Washer-Scrubbers, with **WOOD CLUSTERS**, and Tar Extractor combined.

PHŒNIX ENGINEERING WORKS,

PARK STREET, SOUTHWARK, LONDON, S.E.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN VERY EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Chief Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

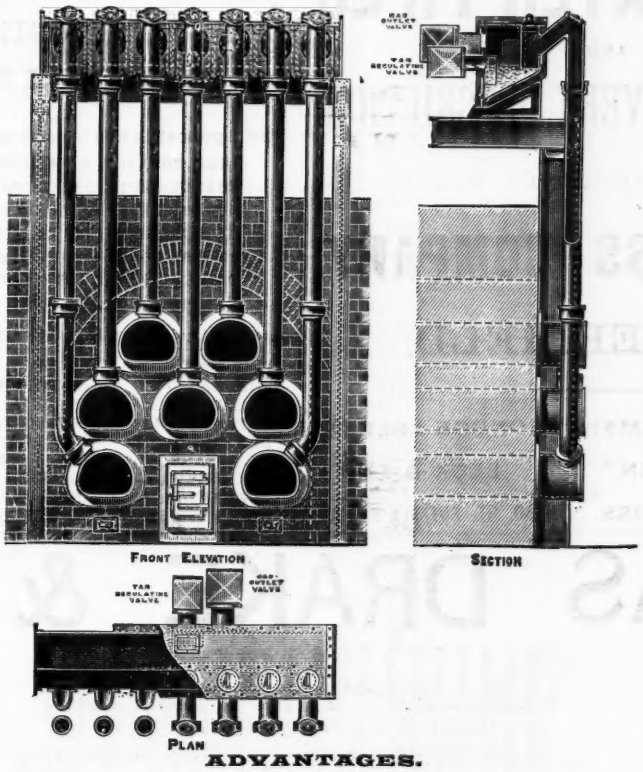
THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

R. & J. DEMPSTER, LIMITED
GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.
SOLE MAKERS OF
WINSTANLEY'S PATENT HYDRAULIC MAIN.

LESS LABOUR.
LESS LEAKAGE.
LESS COST.



MORE COMFORT.
MORE GAS.
MORE DIVIDEND.

ADVANTAGES.

No Bridge-Pipes (liable to make up) are required.
Dip-Pipes of various Lengths and Seals are abolished.
The Ascension-Pipes are reduced considerably in length.
The Gas is more quickly sealed off from the Retort.
The liability to Stopped Ascension-Pipes is reduced.
The Cost of Fixing and Renewals is reduced.
The trouble of Cleaning and Pipe Jumping is reduced.
The Weight upon the Mouthpiece is relieved.
The Height of the Retort-House can be reduced.
The Hydraulic Main Cover can be removed without disturbing any Pipes or Connections.
No thick Tar is allowed to accumulate and partially distil inside the Hydraulic.
The Cost of Retort Ironwork is reduced.
The Appearance of the Retort-House is improved.
The number of Joints that can possibly leak is reduced to a minimum.
The Seal is uniform on all Retorts, and is always formed by Liquor.

ILLUSTRATIONS, PRICES, AND FURTHER PARTICULARS ON APPLICATION.

London Offices: 181 & 182, GRESHAM HOUSE, OLD BROAD ST., E.C.
Telegrams: "SCRUBBER, MANCHESTER."

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW. M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE
CLAY CROSS COMPANY,
CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
8 X 0	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S
IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,
ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—
BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD	ORMSKIRK.	LUTON.
		HAMPTON COURT

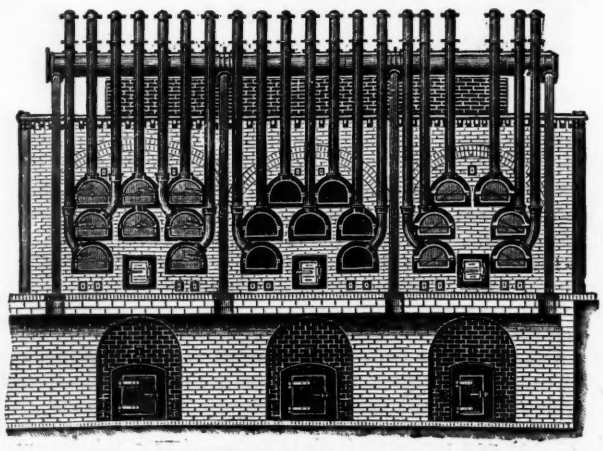
JONAS DRAKE & SON,

TELEGRAPHIC ADDRESSES:
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON."

TELEPHONE No. 43.
HALIFAX EXCHANGE.

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S VALON'S, SOMERVILLE'S PONSARD'S and other Principles.

INCLINED RETORTS

GASEOUS FIRING A SPECIALTY.

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

LONDON OFFICE:
60, QUEEN VICTORIA ST., E.C.

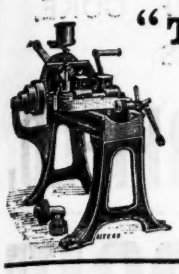
OVENDEN, HALIFAX.

John Cowley & Son

MANUFACTURERS OF

SCREWING MACHINES AND GENERAL TOOLS FOR ENGINEERS AND GAS-FITTERS.

SOLE LICENSEES AND MANUFACTURERS OF



"TURNER'S" PATENT TAPPING APPARATUS

FOR DRILLING AND TAPPING GAS, WATER, OR OTHER MAINS UNDER PRESSURE.

ILLUSTRATED LIST ON APPLICATION.

CLARENDON STREET,

HYDE, near Manchester.

TELEGRAPHIC ADDRESS: "COWLEY, HYDE." TELEGRAPH CODE: "A B C, 4TH EDITION."

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

Abercorn Foundry and Abbey Works,

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MAKERS OF

Gasholders and Gas Plant

OF EVERY DESCRIPTION.

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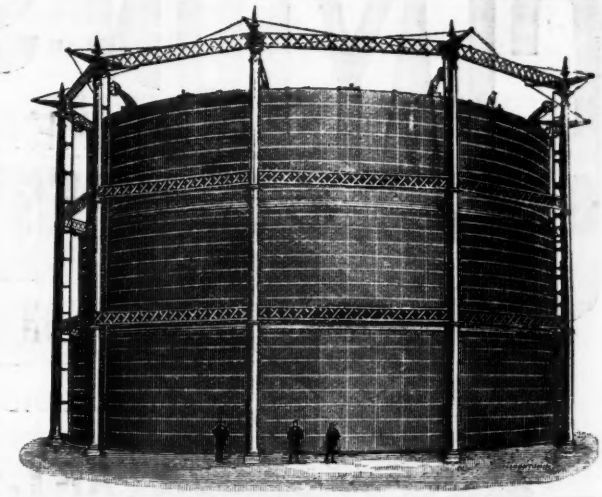


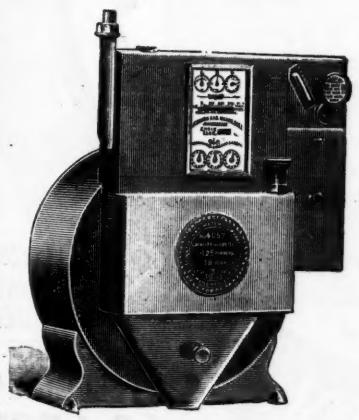
THE AUTOMATIC GAS-METER CO., LTD.,

UPPER BROOK ST., MANCHESTER.

SOLE PROPRIETORS OF

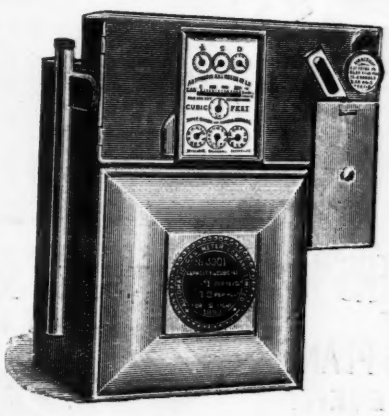
THORP, MARSH, AND HAYNES' PATENTS.

PENNY-IN-THE-SLOT GAS-METERS.



The amount of Gas given in exchange for Coin can be altered *in Situ.*

The amount of Cash placed in the Box is recorded; and this is a complete check against fraud.



PENNY-IN-THE-SLOT GAS-METERS.

PRICES AND FULL PARTICULARS ON APPLICATION.

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MANCHESTER: UPPER BROOK STREET.

LEEDS: 5, MERRION STREET.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

CLAYTON SON & Co. LTD

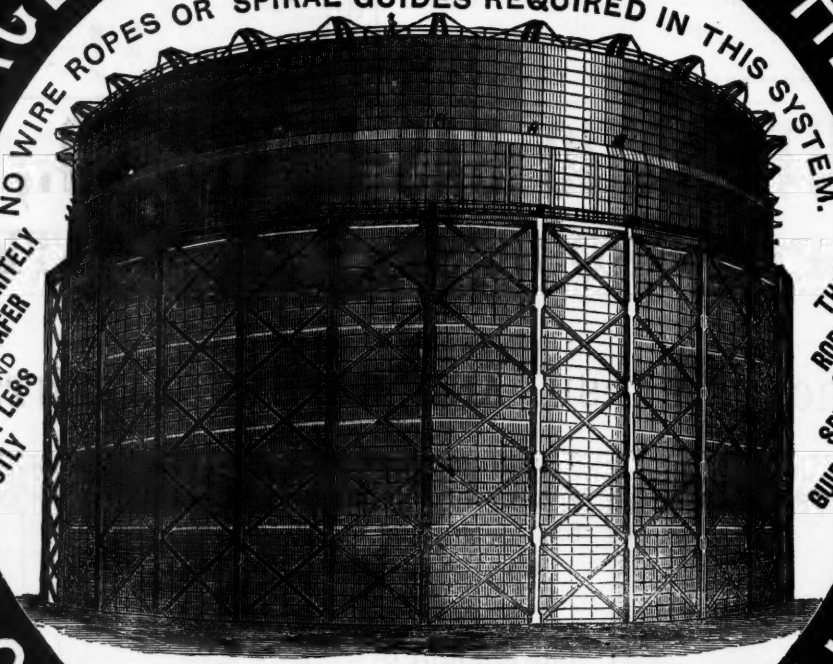
MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.



INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.

CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.

TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

STOURBRIDGE RETORTS AND FIRE-BRICKS.

BEST QUALITY.

KING BROTHERS, STOURBRIDGE.

[See Illustrated Advertisement, Jan. 2, p. 41.]

IRISH OXIDE OF IRON.

GAS PURIFICATION.

RIKY'S OXIDE (formerly worked by Messrs. Stanley and Olphert).

THE LARGEST SUPPLY OF OXIDE IN HAND OF ANY OTHER FIRM IN THE WORLD.

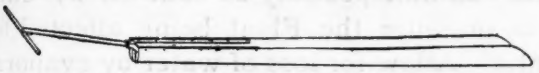
Purity and Uniformity of Quality Guaranteed.

RIKY AND Co. can supply the above at a much lower rate than any other firm in the trade, being owners of the property where it is found. *No Middleman* or *Agent* receives a profit.

SAMPLE AND PRICE ON APPLICATION.

Address JOHN RIKY AND CO., Killygordon, County Donegal; and 193, Great Brunswick St., Dublin. Telegrams: "RIKY, KILLYGORDON.

STEEL SCOOPS FOR RETORT CHARGING.



Scoops supplied with or without handles, and of any dimensions or shape required.

HENRY SYKES, Engineer,
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Gas-Bags for Mains. High Water-Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpauling Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber. Stokers' Gloves, 14s. 6d. per dozen.

Write for Price List to

THOMAS BUGDEN, Manufacturer,
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The Climax of Regenerative Gas Lighting!!

THE

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A 280-CANDLE POWER PLAIN IRON LAMP,

CLASS A— 55/-

LIGHT for LIGHT less than half the price of any other Regenerative Lamp.

Manufactured in England by

HENRY GREENE & SONS,
153 & 155, CANNON STREET,
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PARTICULARS AND PRICES FREE. AGENTS WANTED.

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MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.

ESTABLISHED 1836.

OSLER, BIRMINGHAM.

MANUFACTURERS OF GASELIERS IN GLASS AND METAL.

ARROL-FOULIS

Patent Automatic Machinery FOR DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,
GLASGOW.

See Illustrated Advertisement, p. II. Centre of JOURNAL for Jan. 2.

JOSEPH CLIFF & SONS,

INCORPORATED IN THE LEEDS FIRE-CLAY COMPANY, Ltd.,

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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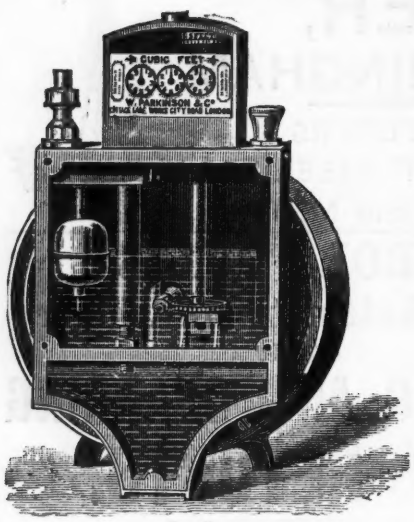
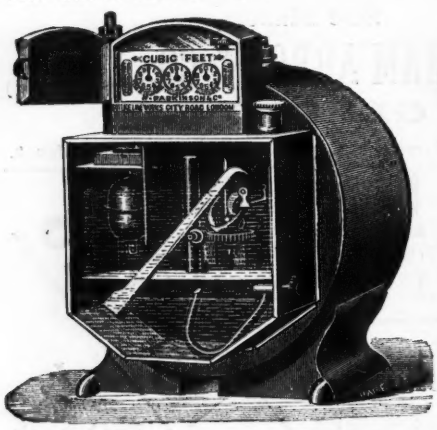
OLDEST ESTABLISHED FIRM IN THE TRADE.



ORDINARY WET METERS

IN CAST-IRON CASES.

Work with very little friction. Will stand very high pressures. Cannot possibly be shut off by sudden increase of pressure, the Float being affected by Outlet Gas only. Allow for loss of water by evaporation without materially affecting the registration or shutting off the gas. Unexcelled for simplicity of construction, excellence of workmanship, or accuracy in registration.



COMPENSATING METERS

IN TINNED OR CAST-IRON CASES.

The Slow-Spoon Compensator has been in extensive use for many years; it maintains an unvarying water-line without appreciable friction, and provides a large reserve of water. The Float arrangement allows sudden or excessive pressure on the Inlet without affecting the working of the Meter or extinguishing the Lights.

DRY METERS.

These Meters are unsurpassed for accuracy of registration. The cases are made of the best Charcoal Tin Plates; and each part of the Meter is stamped by special Machinery to ensure uniformity and exactness in construction. The Diaphragms are all of the best Persian Sheep Skins, carefully selected and the brasswork and smaller fittings are of superior workmanship.

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Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
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Telegraphic Address: "GAS-METERS."

10, MAWSON'S CHAMBERS, DEANSGATE
MANCHESTER.
Telegraphic Address: "PRECISION."

(See also Advt. p. 142.

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